September 2017

FORESTS AND THE COMPREHENSIVE PLAN: A Planner's Guide

A Project of the South Carolina Forestry Commission

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1 INTRODUCTION: Comprehensive Plans in South Carolina

Comprehensive plans are a key tool used by South Carolina's communities to assess, evaluate and plan for their growth and development. South Carolina law requires that every city and county develop such a plan for its locality. Those plans should include strategies for natural resources, including forests and woodlands. This guide is intended to help each locality understand what key forest polices they can consider, as well as recommended approaches for successful strategy development.

The Purpose of the Guide

This guide offers strategies for conserving or restoring local forests using the comprehensive planning process. All comprehensive plans should include information about the extent and condition of local forests along with strategies for their protection. This guide suggests key considerations, steps and examples communities can use to implement information-rich, visionary and strategic plans for their forests within their comprehensive plans.

While this guide focuses primarily on the Natural Resources section of the comprehensive plan, it mentions possible impacts that other comprehensive plan elements might have on forests. In addition, since forest policies can be impacted by, or specifically included in other sections of plans, such as guidelines for entrance corridors, road building, protecting water supplies, and so on, those various strategies and tools currently being utilized by South Carolinian localities are also included. The ultimate goal of this guide is to help local governments and others create more effective comprehensive plan policies that protect and conserve South Carolina's forests and habitats.

Project Background

The SC Forestry Commission (SCFC) was established in 1927 to protect the state's forests, promote the benefits of forest management, and to monitor the forests' condition. They produced this guide to help planners engage with their local, regional or state foresters. To date, the SCFC has engaged in several key initiatives in the past few years to bring foresters and planners together to manage South Carolina's forests better:

- The Forest Resources Institute for Planners and Foresters
- A Green Infrastructure Planning Guide and Pilot Studies
- Review of Comprehensive Planning for Forests

In 2015, the SCFC, with funds from the USDA Forest Service, supported the nonprofit environmental mapping and planning firm, the Green Infrastructure Center (GIC) to develop a model to assess and analyze state's large intact habitats (forest, wetland and dune) in South Carolina to use for green infrastructure planning. The resultant habitat model for the entire state of South Carolina is a key tool that helps counties plan for a connected and resilient landscape. The SC Green Infrastructure Habitat Model can be utilized to inform comprehensive plan policies. For more information on this model, see the *Appendix A: Resources* at the end of the guide; also see Chapter 4 for recommended data sets to use for evaluating local forests.

Forestry in South Carolina is number one among manufacturing industries in jobs and payroll. The state exports about $1 billion in forest products each year and timber is the state's number one agricultural commodity, at $870 million annually.

In 2016, the SCFC provided a grant to GIC to determine the extent to which localities include forest protection as key goals in their comprehensive plans. The GIC contacted the majority of counties and also several cities across South Carolina to assess the current forestry related policies within their comprehensive plans. Many of the ideas garnered from that research are presented in this guide. It should be noted that, while South Carolina requires all localities to complete comprehensive plans, not every locality had one at the time this report was compiled, or it was not easily accessible to the public, although by law they should be.

Important Note

Readers of this Guide should be aware that it is not a guide for how to *write* a comprehensive plan. Such general guidance for writing comprehensive plans can be found in the Municipal Association of South Carolina's *Comprehensive Planning Guide* for Local Governments. Additional guidance for forest evaluation and urban forest planning can be found in *Planning for the Community Forest in South Carolina*. This guide focuses specifically on the reasons for including a forestry strategy, along with specific goals and actions that should be included within a comprehensive plan. It suggests tools for evaluating key forest resources in urban and rural areas and provides sample plan goals for forest conservation or restoration.

Audience: Planners and Policy Makers

The primary audiences for this guide are rural and municipal planners, elected and appointed government decision-makers. However, this guide could also be utilized by anyone who wants to use comprehensive planning to protect, restore or expand the state's treasured trees such as foresters, conservation groups or land trusts.

This guide provides a tool for planners to understand why and how forests should be key aspects of comprehensive planning in South Carolina. While most people agree that trees have value, they may be overlooked when key decisions are made about growth and development. This guide outlines the values forests provide, recommends methods and tools their assessment, and tips for creating a useful and actionable comprehensive plan.

This guide also describes the information that foresters can share with planners, when they are engaged in the process. All too often, planners do not know or work with all the potential resource experts available to them. This is because planners may not realize that they lack key environmental data, and foresters may not know what information planners need; by working together, planners and foresters can ensure that the best possible plans are developed and create more opportunities for healthy forests into the future.

FORESTERS AND PLANNERS: A KEY COLLABORATION FOR ECONOMY, ECOLOGY AND PUBLIC SAFETY

As explained in this guide's introduction, foresters and planners need to work together in order to create a comprehensive plan that best protects, promotes and expands forest resources. For cities, this means collaboration amongst urban planners, the city arborist, parks and recreation planners and regional urban forestry commission staff.

For rural localities, collaboration should occur between regional and county foresters, planners, extension agents, and others who impact the rural economy and land development. If there are key conservation groups or land trusts, which hold or manage significant lands, or private forest landowners managing significant acreage, consider engaging with them as well. For a complete list of stakeholders and process tips, see *Evaluating and Conserving Green Infrastructure Across the Landscape: A Practitioner's Guide* in the resources section.

Ask stakeholders about their plans, needs and challenges. This can be accomplished through one-on-one discussions, or by holding a roundtable discussion in which key landowners and other stakeholders assemble to answer key questions about their goals and challenges to managing their landscapes for forestry, conservation or other values. Ask them whether they need assistance in better protecting their forest uses. At the very least, this information sharing can avoid future conflicts. For example, a road routinely used by logging trucks may not be an appropriate place for a new subdivision entrance unless sight lines are well defined and road capacities and widths are adequate. Similarly, if too many subdivisions are allowed to proliferate, this could eventually drive out forestry uses.

Forest fire is another key concern. The best way to avoid fire risk is to not build subdivisions in areas that are 1) prone to fire, 2) difficult to access or remote from fire stations and 3) in conflict with other rural land operations, such as large milling operations. For existing subdivisions, communities can become *fire wise* by following principles from the US Forest Service's Ready, Set, Go Program. Foresters should contribute their expertise on the key locations for forestry, milling and processing operations and areas where forestry may be at risk as well as any knowledge of significant trees. See the resources section for more.

Forests impact most aspects of the comprehensive plan including drinking water, fisheries, and locations for development, rural economies and urban revitalization.

Comprehensive Plans and Forests: What's Included

To evaluate the guidance needed, the authors first researched what is currently included in South Carolina's Comprehensive Plans. The research conducted for this guide included a review of 30 South Carolina localities as to the degree to which they included forests in their comprehensive plans. All counties were contacted, along with several representative cities, but not all were able to provide a comprehensive plan.

Among those factors evaluated were the extent to which each community mentioned forests, forest benefits, and whether it had developed specific strategies for implementation.

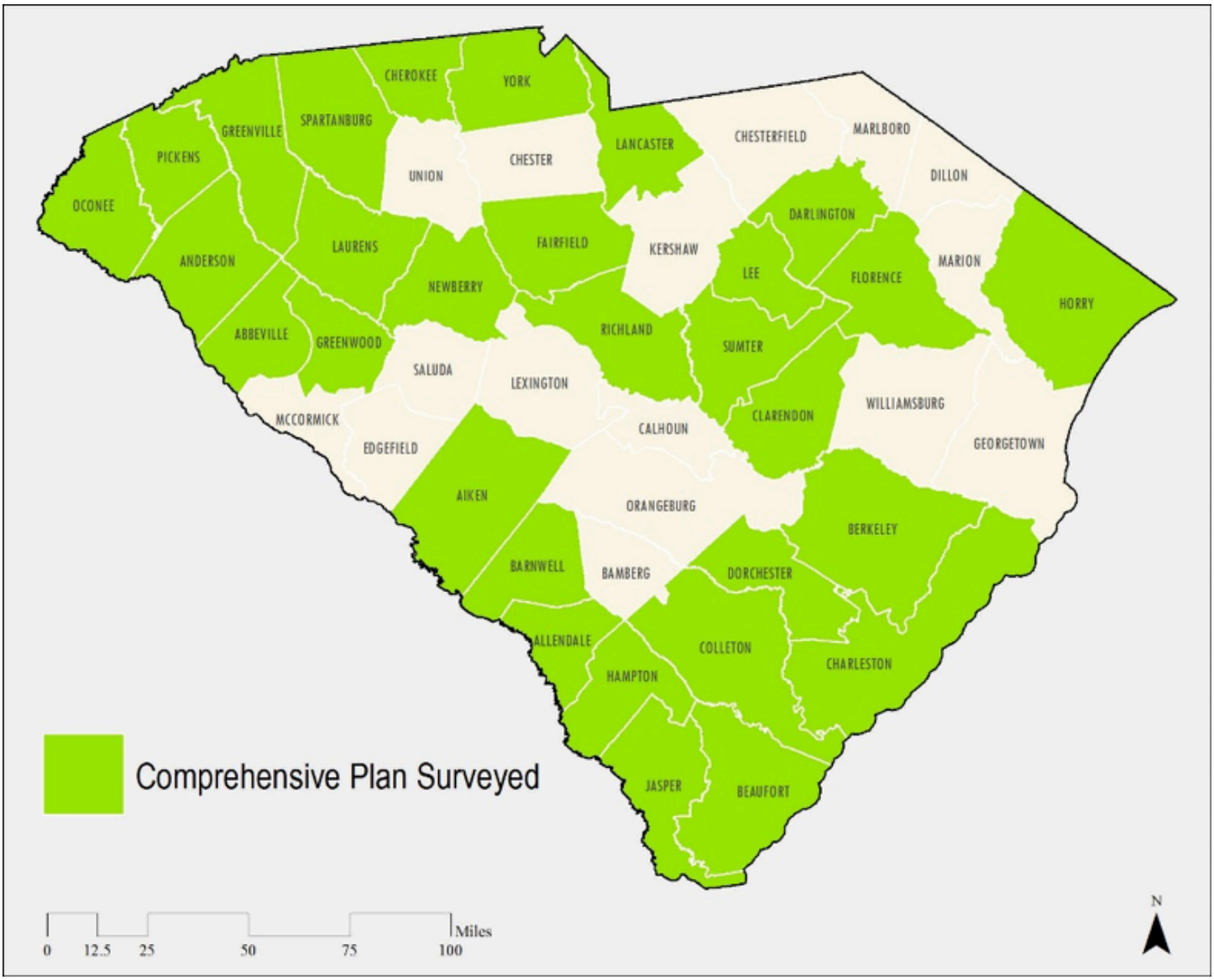


TABLE 1.1: COMPREHENSIVE PLANS REVIEWED, BY REGION.		
PIEDMONT (INCL. MOUNTAINS)	MIDLANDS (SANDHILLS)	COASTAL (MARSHLAND AND PLAIN)
Abbeville	Aiken	Beaufort
Anderson	Allendale	Berkeley
Cherokee	Barnwell	Charleston
Fairfield	Clarendon	Colleton
Greenville	Darlington	Dorchester
Greenwood	Lee	Florence
Lancaster	Richland	Hampton
Laurens	Sumter	Horry
Newberry		Jasper
Oconee		
Pickens		
Spartanburg		
York		
13 of 18 (70%)	**8 of 15 (55%)**	**9 of 12 (75%)**

In all, 194 criteria, in eight separate categories were evaluated, with Benefits of Forests further subdivided into five sub-categories. Table 1.2 shows the forest related topics mentioned and the frequency of occurrence in comprehensive plans. Other tables showing the results of this research are found in Appendix C.

It is clear from this table that forest issues were a significant concern for the majority of the localities; most of them took a variety of actions to protect their forest cover, and many had developed specific goals for forestry. However, what is not obvious from those numbers is that some plans barely mentioned forestry, and many more took a piecemeal approach to their local tree cover. Typically, the forestry elements of the plans were not coordinated and there was no consistent or complete strategy for forests, nor a coherent list of goals and actions that would ensure the well-being of their forests and urban tree cover. Forestry, when mentioned, was often referred to only in passing; and there was rarely a complete strategy outlined, even as a local economic factor or benefit. And, in fact, many respondents indicated that a significant proportion of forestry related programs that were mentioned in their comprehensive plans were not being implemented.

The lack of implementation details was sometimes a consequence of using outside help to create the plan, or using boilerplate language to fill in plan elements. Some localities hired consultants to write their plans and, in some cases, the same paragraphs were copied from one plan to another, with similar goals expressed. While employing someone from outside the county to write background information and pluck goals from a template is not necessarily problematic, the county may not be completely committed or engaged with the resulting plan, as they had little role in crafting it.
As a result, the authors discovered some incongruity with a number of counties expressing very ambitious goals while indicating a very low capacity for implementation (e.g. low resources, lack of staffing, or lack of political will).

TABLE 1.2: NUMBER OF TIMES A TOPIC WAS MENTIONED BY 30 SURVEYED LOCALITIES.	
FOREST TOPICS MENTIONED IN COMPREHENSIVE PLANS	MENTIONS
Forest/forest resources	27 (90%)
Benefits of forestry (overall)	29 (97%)
Economic benefits	25 (83%)
Human health benefits	27 (90%)
Environmental benefits	24 (80%)
Aesthetic benefits	28 (94%)
Forest economic value	25 (83%)
Economic incentives	20 (67%)
Urban forests	21 (70%)
Forest health	13 (43%)
Species habitat and protection	27 (90%)
Interconnected landscapes/green infrastructure	13 (43%)
Actions for implementation for forest-related goals	26 (86%)
Threats to forestry	28 (94%)
Ecosystems and directed development	27 (90%)
Protecting forests	29 (97%)

What Is a 'Forest' and What Is Not?

One of the most notable findings of the review of comprehensive plans was the varied and often vague notions of 'forest' used in many plans. There was rarely a specific definition given; rather, a variety of non-specific terms, and undefined terms were used, notably:

- forest
- forestry
- woodland
- wetland
- natural resource
- rural area
- natural habitat

At right, are the 'official' state definitions for forestry.

More often, "forestry" or "forests" are not specifically mentioned or distinguished in a goal or description, even when they are clearly meant to be included. For example, the plan for a county which is mostly forested never mentions forests in its goals or actions, and yet clearly forests are meant to be included when it talks about the importance of forested landscape features or creates goals to protect stream buffers, hunting, outdoor recreation and natural resources. Often, general terms, such as "natural resources" or "the rural landscape" are used which encompass forests. Furthermore, forests are often called 'woodlands', or are described as 'wetlands', when *forested* wetlands are clearly indicated.

Variability Among Localities

The research evaluated whether forest conservation or restoration goals were included in the comprehensive plans. Some plans both mentioned forest benefits and had distinct actions to protect or restore them, such as those for Beaufort, Newberry and Florence, and they clearly were intending to protect forests. Another exemplar comprehensive plan, York County, discussed specific benefits of open space conservation, such as protecting wildlife and protecting jobs, and also identified specific programs and conservation partners to carry out the work.

Beaufort County residents have long recognized the value of protecting significant trees, for both aesthetic and practical reasons. Trees provide numerous public benefits including:

- **the reduction of stormwater runoff**
- **buffering noise from roads**
- **reducing energy costs in shaded buildings**
- **providing wildlife habitat**

STATE CODE DEFINITIONS: TITLE 48 - ENVIRONMENTAL PROTECTION AND CONSERVATION

Chapter 23: Forest Generally
Local regulation of development affecting forest land.

SECTION 48 23 205. Local regulation of development affecting forest land. "Forestland" means land supporting a stand or potential stand of trees valuable for timber products, watershed or wildlife protection, recreational uses, or for other purposes.

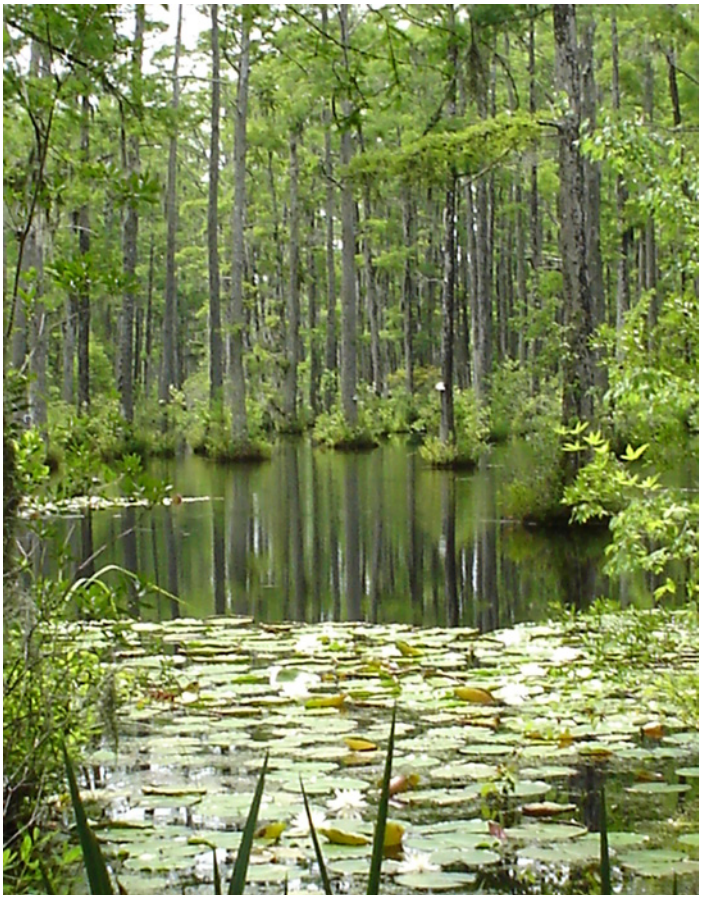
(3) "Forest management plan" means a document or documents prepared or approved by a forester registered in this State that defines a landowner's forest management objectives and describes specific measures to be taken to achieve those objectives. A management plan shall include silvicultural practices, objectives, and measures to achieve them, that relate to a stand or potential stand of trees that may be utilized for timber products, watershed or wildlife protection, recreational uses, or for other purposes.

(4) "Forestry activity" includes, but is not limited to, timber harvest, site preparation, controlled burning, tree planting, applications of fertilizers, herbicides, pesticides, weed control, animal damage control, fire control, insect and disease control, forest road construction, and any other generally accepted forestry practices.

While 25 of 30 plans mentioned economic benefits, only 16 mentioned timber and forest products, and only 12 mentioned jobs. Tourism and outdoor recreation were more popular as an economic benefit of forests and they were mentioned 22 times for both categories. This suggests that many localities (or their plan writers) lack a clear understanding of the range of forest benefits and their significance to local economic wellbeing. For additional findings, see the Tables in Appendix C.

Comprehensive plans are big picture looks at the current and future plans for a locality. However, rural areas which are important for forestry should be identified. This can provide a clear signal that if long term use for forestry is expected, these areas may not be appropriate for large subdivisions or other less compatible uses. When creating strategies or seeking to understand forest management challenges, engaging with the development community and large landowners is also recommended.

If the goals of the plan are to ensure long term viability of forested landscapes, then careful attention must be paid to how land is zoned and which land is protected. In addition, there needs to be more landowner and community education about forest benefits, risks and opportunities. Section four of this guide provides the essential information to include. The resources section provides references for key citations used in this guide and helpful sources to make the case for forest conservation.



2 Why Forests Should Be Included in Comprehensive Planning

Forest Benefits

Forests support our very existence. Everyone who breathes air, drinks water or eats food is benefiting from ecosystem services provided by trees. Correspondingly, as we lose trees, our ability to provide 'ecosystem services', such as absorbing and filtering land runoff, providing oxygen, filtering air pollution, shading cities, supporting pollinators or wildlife and providing recreation are likely to decline. Concerted attention and action are needed to ensure we create and care for a robust forested landscape to protect both our future and the future of the ecosystems we rely upon for our economy, community health and fish, birds and wildlife. And that requires foresight and planning. Thus, caring for rural and urban forests alike, requires attention, planning and funding to ensure they can survive and thrive.

Forests and woodlands include many South Carolinian wetlands vital for the protection of wildlife, fish spawning grounds and clean water. Forests also support the habitat for local game species to forage and reproduce. Forests in urban areas also provide shade and beauty for shopping and commercial areas and parks, or buffer runoff for a locality's rivers, lakes and streams. They provide the welcoming entrance corridors to cities and towns, provide habitat for rare and endangered species, and are essential for supporting fish and wildlife and outdoor recreation.

In rural areas, forests provide many jobs in the timber, finished wood products and associated industries. They also generate income from tourism and outdoor recreation, such as hunting, hiking and birding. They provide the context for many of the tourist and leisure activities along South Carolina's coastlines, framing the beauty of marshlands and estuaries, and attractive areas in the Piedmont and mountains where people can kayak, vacation, camp, hunt or fish or just enjoy the wonderful scenery the state has to offer.

In cities, forests also provide myriad benefits including keeping them cooler, improving air quality, calming traffic, improving property values, facilitating tourism, providing beauty and supporting birds, wildlife and pollinators. Urban forests, even as small as an acre, provide tremendous benefits and even individual trees, such as street trees and yard trees, improve the habitats for both people and wildlife. Urban forests also require care to ensure trees are healthy, long lasting and replaced as they age and die with new plantings.

Forestry is not just impacted by natural resources strategies, goals and ordinances. It can be impacted by other areas of a comprehensive plan as well, such as transportation, economic development, land use and cultural resources, so it is important that an overarching strategy and a consistent and coherent system of goals are developed for forests that can be applied across the entire plan. Otherwise, it is quite possible for contradictions to occur within a plan. For example, the Natural Resources section might stress protecting wildlife corridors, but the Transportation and Housing sections completely ignore that goal in suggesting locations for new highways that impact sensitive habitats.

However, forests can be impacted by both housing developments and new roads. Development can significantly impact water supply by removing trees that filter runoff or help recharge aquifers. As such, policies adopted in just about every section of a comprehensive plan can potentially impact urban tree cover or rural forests. Local planners, supervisors and councilors should be cognizant of the fact that even seemingly innocuous policies, such as the width of sidewalks or specifications for retail zoning, can have significant implications for an area's trees.

Why Conserve Mature Forests

Oftentimes, forests are removed for development and new trees are planted to replace a fraction of those lost. However, it's important to protect as much forested land as possible and to reduce tree removals. A new forest, or a new tree, does not immediately replace the value of a mature forest. A mature forest, which will tend to support more rare species of plants, animals and larger trees, is not the same as a new forest springing up in an old field. It will take decades to even approach the same quality as an established forest cut down and converted to development. Trees that are growing in a former field may be stunted by poor soils from overly intensive farming or grazing, or uprooted by excessive runoff, leading to more invasive or opportunistic species, such as ailanthus ('tree of heaven'). Although young forests provide other values (more open meadows for quail or ruffed grouse, for example), they can't provide the same assets as a mature forest.

Mature, older forests also have a thick layer of organic matter (the 'duff layer'), which builds up over time as leaves, bark and other detritus collect on the forest floor. This layer plays a key role in the biogeochemical process of the forest, helping to transfer nutrients as materials decay, keeping soils moist and absorbing the impact of rainfall. The duff layer acts like a sponge, holding water and filtering it so that there is less runoff, less erosion and cleaner water for both wildlife and people. It provides exceptional habitat for invertebrates and fungi. It also provides food and habitat for small mammals, reptiles and amphibians, which in turn are a food source for larger predators, such as foxes, raccoons and bobcats. The duff layer also supports a rich variety of microbes that play a key role in the forest ecosystem. The problem is that, in new forests, this layer is very thin or even non-existent as it takes time to build up.

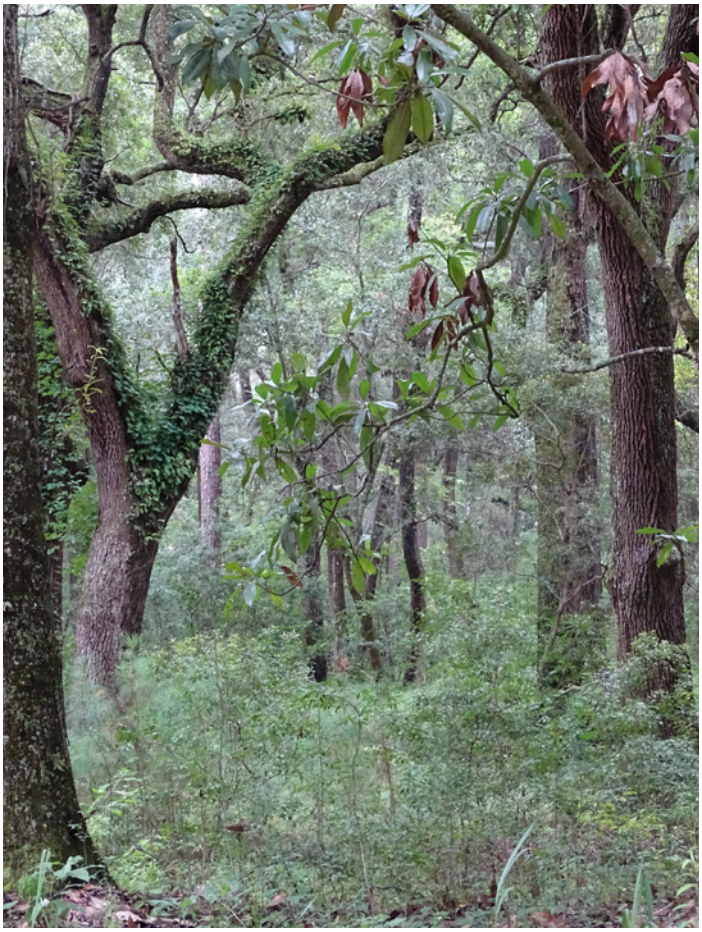
Similarly, forested wetlands – swamps and treed islets within marshes -- provide unique habitats for amphibians, reptiles, plants and insects, such as the common red spotted newt and the frosted flatwoods salamander, and for migratory birds, such as the swallow-tailed kite. For example, the Savannah, Combahee, Ashepoo, Edisto, Cooper, Santee, Congaree, Wateree, Pee Dee, and Waccamaw rivers support highly significant wildlife habitats. Extensive palustrine forested bottomland hardwoods and swamps adjacent to those rivers provide abundant wildlife habitat, accounting for up to of 3.7 million acres of such forested wetlands, primarily in the coastal plain. As these forested wetlands lie along the fastest growing coastline in the eastern U.S., they are at serious risk.

Frosted flatwoods salamander

Swallow-tailed kite

SEVERAL REASONS WHY INCLUDING FORESTS IN COMPREHENSIVE PLANS IS IMPORTANT

- Forests should be mapped and evaluated, so that they are not ignored when locating subdivisions, shopping malls, roads, schools, and so on, in the future land use plan.
- Trees are essential for healthy watersheds. Well forested watersheds provide clean drinking water, habitat and wetlands for fish, game and wildlife, and protect communities from excessive stormwater runoff and flooding. Preparing for these challenges – becoming more resilient – requires the adequate maintenance of forest buffers and the urban tree canopy as part of an overall strategy to address community safety and hazard mitigation.
- A vibrant, rural timber economy requires a coherent strategy that gives support for mills and wood product processing that will sustain nearby supplies of healthy trees and policies that allow for landowners to continue to own and manage land for forestry. It's not adequate to merely offer support for a 'rural economy' and not recognize and map the natural resources that support it.
- Economic development in rural economies should consider forestry as a central aspect for any plan, since so many jobs are dependent on healthy, sustainable forests. These include tourism, hunting guides, outfitters and sporting equipment retailers, bed and breakfast establishments, rural restaurants, specialized furniture makers and wood crafts to name a few.
- The comprehensive plan guides funding decisions. Cities and towns are losing their trees, yet many cities lack arborists and have not performed canopy assessments. Tree planting, care and maintenance are often underfunded. If urban forestry is not recognized as important in the comprehensive plan, then it's unlikely that a locality will spend the money to ensure that street trees and woodland parks and stream buffers are adequately maintained.
- Transportation plans needs to be cognizant of a locality's policy for greening its entrance corridors, protecting its viewsheds, screening housing developments from road noise, avoiding fragmenting core habitats, protecting wetlands and clean water resources, and potential pollution impacts. These all involve trees.
- Since zoning must be in accordance with the comprehensive plan, if zoning decisions are to consider forests, then the strategy and goals for those forests need be detailed and locations for key forest resources need to be specified. Specifically detailing the importance of forestry and the physical locations of prime forestry tracts and key areas of treed landscape that should be preserved allows land use plans and zoning to support them.



Forests provide unique habitats for an extensive variety of species, such as the bobcat, black bear, pileated woodpecker and alligator. Preserving their habitats preserves the ecosystems of the state and allows both animals and humans to thrive.

Careful planning for future growth and development are critical to ensuring that South Carolina's landscapes, quality of life and economy are not just sustained but enhanced. While many may see comprehensive plans as just cataloguing values and providing supporting statistics, they should also serve as strategic documents, providing key analysis and tactics for creating and sustaining the types of communities desired.

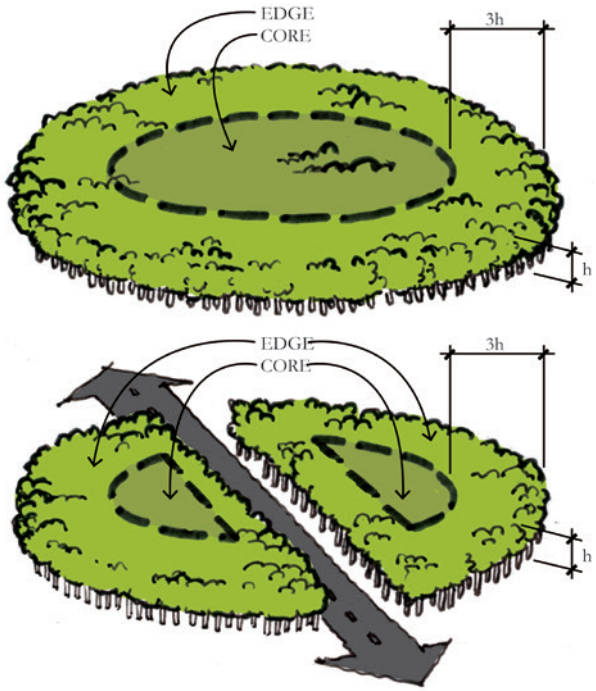
Key Components – cores, corridors and buffers

Forests have long been an integral part of the South Carolina landscape, from the mountainous Piedmont region in the west to the coastal plains and forested marshes in the south and eastern 'low country.' As a southern state facing rapid growth, South Carolina's forested land cover is impressive, accounting for 67 percent, or 13.1 million acres, of the state's land area. However, forested landscapes are not distributed equally statewide and some areas are at risk of losing their forests to land conversion – changing them permanently from rural forest land to developed landscapes.

In addition, while total acreage is important, the quality and intactness of forests is of even greater significance. Indeed, *forest fragmentation* remains the greatest threat to southern forests. Even though South Carolina's forest cover has been relatively stable overall in recent years, this may be in the process of changing, since development is accelerating rapidly.

Forest Cores and Corridors

When evaluating a landscape, whether it is in a rural area or urban, many animals require substantial areas of habitat in which to forage, breed and thrive. These are called habitat *cores*, and consist of an inner area that is undisturbed and an outer *edge* that is usually about 300 feet wide, where the impacts of disturbances from human activity, wind or excess sunlight can impact forest habitat negatively.

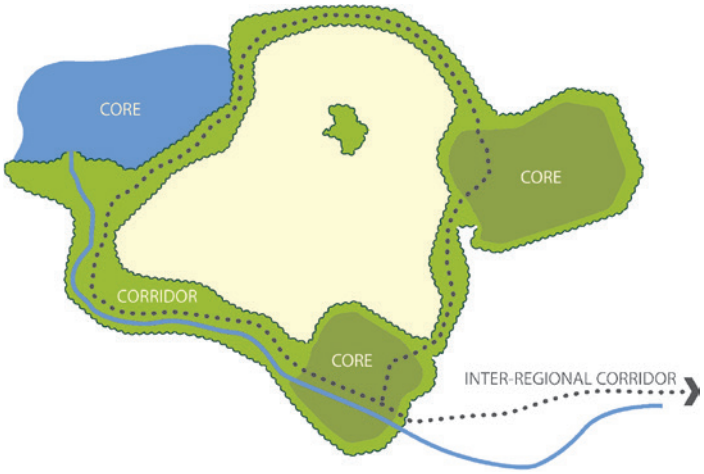


Habitat cores can be fragmented by roads which add more edges and thus more impacts to wildlife.

Wildlife, pollinators and plants need to move between these cores, along *corridors*, which can either be continuous, such as a riparian corridor along a river or stream, or in *patches* that together form a corridor between larger cores. When these corridors are along streams and rivers they can serve as *riparian buffers*. The corridors support biodiversity as they allow species to intermingle and to repopulate areas following disturbances such as hurricanes.

In a rural landscape, there are usually many large cores of intact habitat, with both corridors and patches of undisturbed forest and woodland that animals can use to move between those cores. However, in cities and suburbs, there are few large tracts of undisturbed habitat, which means that species have to rely upon smaller areas, such as parks and streams to move around. But even in cities, corridors can be provided along streams and through back yards.

Taken together, this network of intact forest, wetland or riparian habitats can be considered as 'green infrastructure' because they support our health (air quality, recreation, food) and our economy (drinking water needs, forestry, hunting, tourism) etc. Just as we plan for grey infrastructure, we also need to plan for 'green infrastructure.' For more, see the resources section of this guide.



WHY FORESTED BUFFERS MATTER!

A forested buffer of 100 feet wide can remove more than 90 percent of the nitrogen, phosphorus and sediment from overland runoff. If stormwater pipes bypass the buffer underneath and discharge to the stream directly, then much of the buffer benefits for mitigating polluted runoff are lost. The type of land cover also matters. As a general rule of thumb, impacts to aquatic life tend to be seen even at impervious levels just above 10 percent.

Risk of Forest Loss

From 1992-97, South Carolina experienced the ninth fastest rate of land conversion from agriculture and forestry to urban development. While the rate has slowed since then, development persists in having a significant impact on state forests. A key factor that makes forest land management challenging for South Carolina is that 60 percent of all forest lands are under private ownership in tracts of less than 10 acres. As noted above, forests are disappearing faster in areas subject to rapid growth – at the rate of about 36,000 acres per year.

Today, three of the most rapidly growing metropolitan areas on the U.S. Atlantic Coast are the Myrtle Beach, Hilton Head and Charleston metro areas. Nationally, from 2014 to 2015, they were among the top 20 metropolitan areas that experienced the highest rates of urban population growth. Furthermore, Berkeley, Charleston and Dorchester ranked amongst the nation's fastest growing counties for urban population growth. High rates of growth make it even more important to consider how growth is accommodated without unnecessary loss of the impressive forests and wild areas that support South Carolina's clean water and air quality, wildlife habitat, scenic vistas and hiking, birding, hunting and fishing.

Land is also cleared for other reasons besides development. While South Carolina forests were cleared for farming for hundreds of years, large scale industrial farming may be accelerating this land conversion. For example, since 2012, about 6,000 acres of forests were cleared near the South Fork of the Edisto River in Orangeburg County to make room for potato row-crops as well as a 1,800 acre forested tract cleared for cropland near Aiken recently.

It's important to note that while land conversion is perhaps the greatest threat to tree loss in the state, in urban areas, trees are also lost to attrition. As already developed areas are redeveloped, trees may not be replaced or may be removed. Even if no land conversions occur, failure to replant trees in cities as trees age and die will lead to canopy loss over time. Trees planted poorly (wrong site), not well managed (inadequate care), or planted inappropriately (wrong tree for the site or climate) can also lead to tree canopy losses.

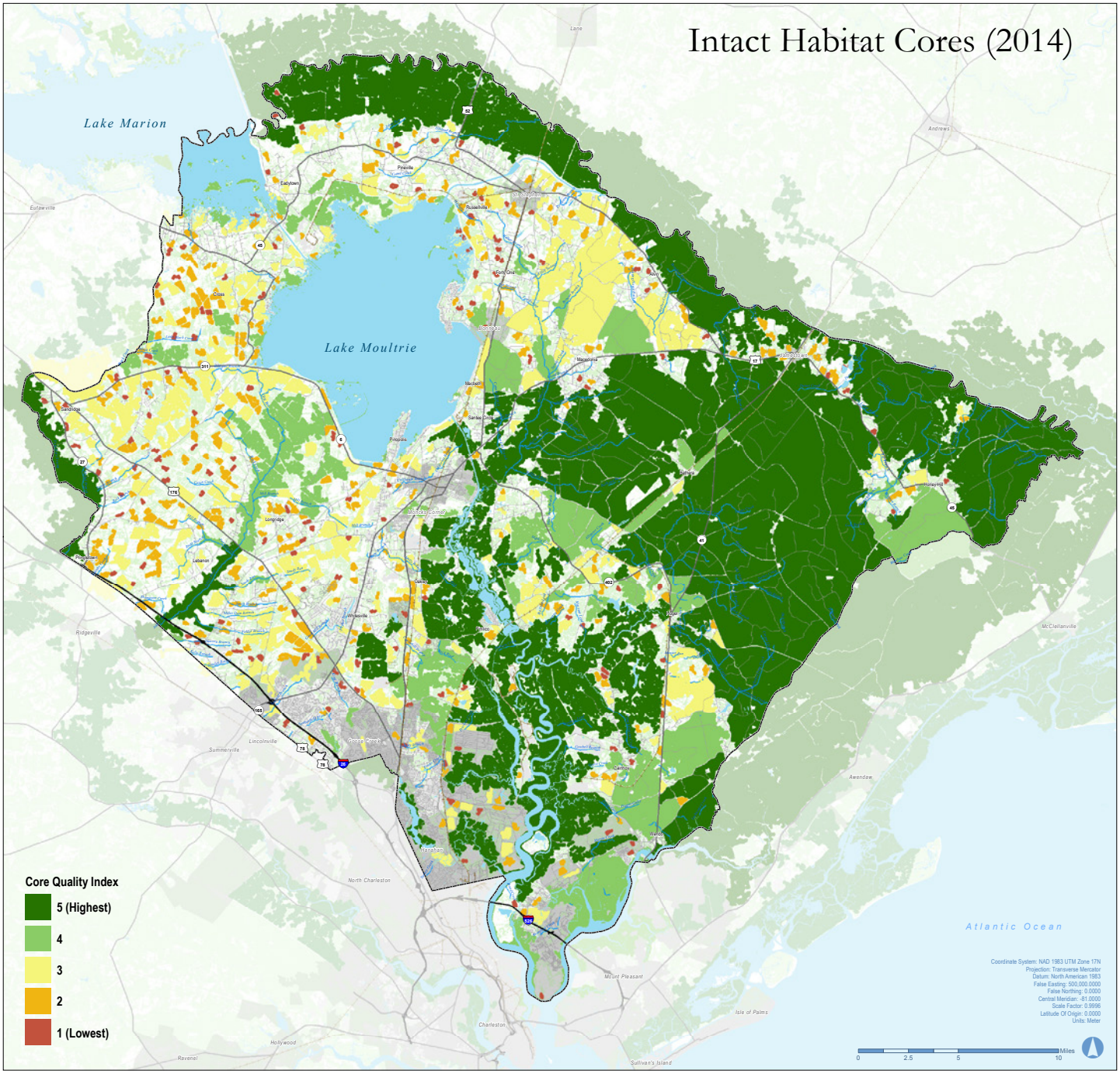
Finally, an important note about forest operations and zoning is that the South Carolina Forest Management Protection Act (Sec. 50-2-10) ensures the ability of registered forestry operations to continue. It states that "No established forestry operation is or may become a nuisance, private or public, if the forestry operation adheres to best management practices as promulgated by the South Carolina Forestry Commission." It does not apply however when a nuisance results from the negligent, improper, or illegal operation of a forestry operation.

What Key Forest Habitats to Include

Rural Landscapes

In South Carolina, the Green Infrastructure Center (GIC) created a model of intact forest habitats for the State Forestry Commission that shows where the highest quality forests habitats are found. It can be downloaded and utilized to create local maps for any area, but does require the use of GIS software. It finds and ranks intact forests of 100 or more acres. Forested areas that are at least 100 acres and not significantly bisected by fragmenting features, such as roads, housing developments or railways, are more likely to support key species of animals, birds, and other wildlife. The model utilizes soils, forested acreage size, surface water, elevation, endangered species presence and other factors to rank those areas most likely to support a diversity of species.

The GIC has also written a guide showing how to create and use maps of these high-value landscapes, so that better decisions can be made about where to concentrate growth and which areas are more suited to rural land uses, such as farming or forestry or water protection. For example, before determining where development should be located in any future land use map, all areas should be evaluated for suitability for development or conservation. Development should be located where it will have the least impact and

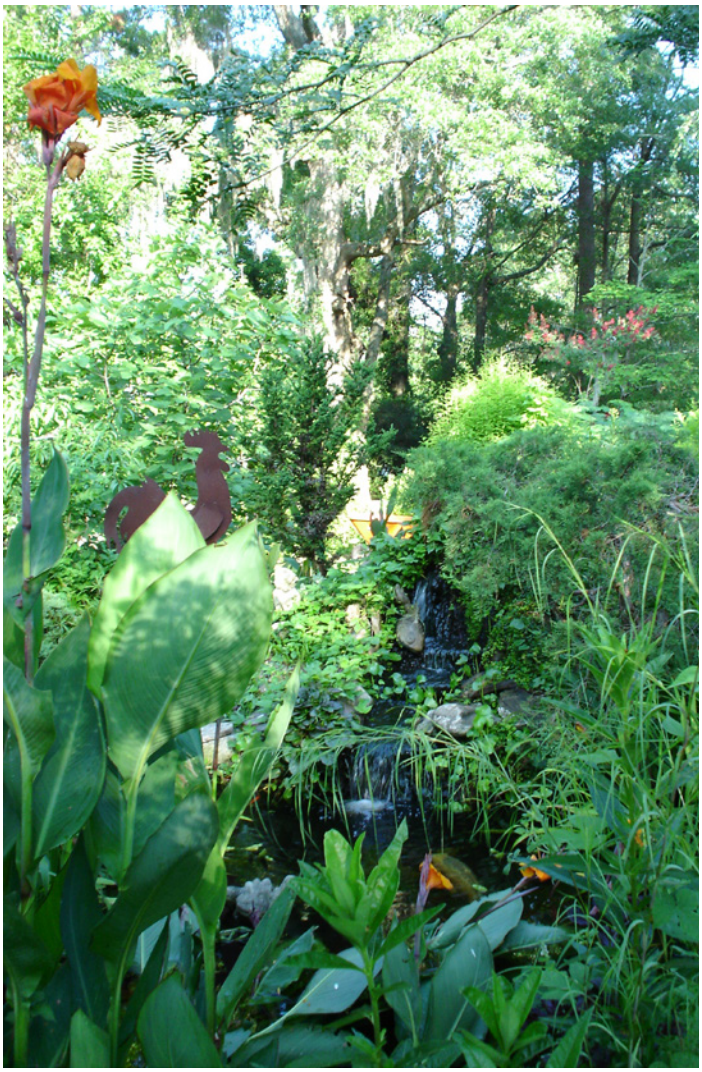


maximize utilization of existing infrastructure, such as already existing roads, schools, water and waste disposal systems, shops and other amenities, while sensitive landscapes and valuable natural resources should be protected and reconnected.

Urban Habitats: Trees In Cities, Suburbs and Towns

In urban areas, landscapes are evaluated at smaller scales and even fragmented patches of green space are important to consider because, together, they can make a large, cumulative difference. Smaller urban spaces, such as linear stream valleys, vegetated swales, or even pocket parks, contribute to the connected green landscape. Tree canopy, surface waters and wetlands form the key natural habitats. When evaluating the ecological health of an urban area, urban tree canopy is a key green asset. Trees provide multiple ecosystem services to make towns and city more livable.

Taken together, clusters of trees, along with other native vegetation, such as shrubs and native grasses, provide important habitats for wildlife. In urban areas, smaller habitats add up and provide myriad benefits for other organisms, such as salamanders, birds, pollinators and other beneficial insects.



A locality should focus on how to facilitate the movement of species through the urban landscape, creating a network of paths, woodland patches, parks, trails, and so on, that create a more beautiful landscape and provide recreation and wildlife movement. Ideal sizes and buffer requirements for streams and woodlands are also provided in the GIC's book *Green Infrastructure Across the Landscape: A Practitioner's Guide*.

Trees = strong economies and vibrant communities

People shop longer and spend 12 percent more in tree-lined shopping districts, so trees in commercial areas help pay for themselves and support town revenues. Tree-lined streets are more desirable and raise property values. *(Wolf 2005)*

A fully successful city or town requires that the entryways, outer neighborhoods, recreation access and parks receive focused attention. The entire city needs to be vibrant, green and well connected in order to thrive. Entryways into the city or town should be well treed and landscaped to provide pleasant travel ways and a positive impression of the city or town as a vibrant, green, attractive and accessible community. Shopping streets and parking lots should consider planting trees to provide shade and places for customers to enjoy.

Both residential and commercial property values increase and commercial spaces rent faster when mature trees are present. When trees are not present, distances are perceived to be longer and destinations farther away, making people less inclined to walk than if streets and walkways are well treed. Businesses often depend on pedestrian traffic to get new customers, so the more walkers there are, the more likely an attractive, street-front store display will lure new shoppers.

The following are issues key to economic revitalization of urban areas. Chief among them is the need to reduce unattractive areas, which are disincentives to economic development and lead to feelings of insecurity and fear of crime.

TREES HELP REDUCE STORMWATER RUNOFF

Cities are beginning to recognize the importance of their urban trees because they provide tremendous dividends. For example, they are a strategic way to reduce excess stormwater runoff and flooding. Studies have shown that an urban canopy can reduce a town's stormwater runoff anywhere from two to seven percent (Fazio 2010). According to Penn State Extension, during a one-inch rainfall event, one acre of forest will release 750 gallons of runoff, while a parking lot will release 27,000 gallons! That is 3,600 percent more runoff from non-forested lands. For a city of 10,000 acres, providing just 10 percent more tree cover could reduce its stormwater runoff by *millions* of gallons during a *major* precipitation event.

Even one tree can play an important role in stormwater management. For example, estimates for the amount of water a typical street tree can intercept in its crown range from 760 gallons to 3000 gallons per tree per year, depending on the species and age. If a city were to plant an additional 5,000 such trees, the total reduced runoff per year could amount to tens of millions of gallons. This means reduced flooding in neighborhoods and reduced stress on waste water treatment plants.

Buffering Surface Waters From Pollution

Urban forests are also critical to buffering surface waters from pollution. However, at certain levels of urban development and related imperviousness, aquatic life (macroinvertebrates, fish, salamanders and other aquatic-dependent species) begin to decline. The rate of decline is affected by factors such as land cover, lot sizes and types of land use, as well as the locations of imperviousness within the watershed. Excessive urban runoff results in pollutants such as oil, metals, lawn chemicals, pet waste and other pollutants reaching surface waters. High stormwater flows result in channel and bank scouring, releasing sediments that smoother aquatic life and reduce stream depth and clog ditches, leading to yet more bank scouring and flooding, as channel capacity is lost.

Tree canopy map

As noted, a key determinant of the health of a stream is how forested its watershed is, not just along the stream, but overall, throughout the drainage. A map of tree canopy by watershed shows which watersheds are well treed and which could benefit from more tree planting. In urban areas, vacant and underutilized parcels often provide opportunities for revegetation and infiltration. A map of vacant parcels can be used to show places that are still undeveloped or empty and might provide options to replant them with trees or to consider developments that have smaller footprints and more open spaces. Developments that have green spaces sell faster and for greater profit per sale (U.S. Association of Realtors).

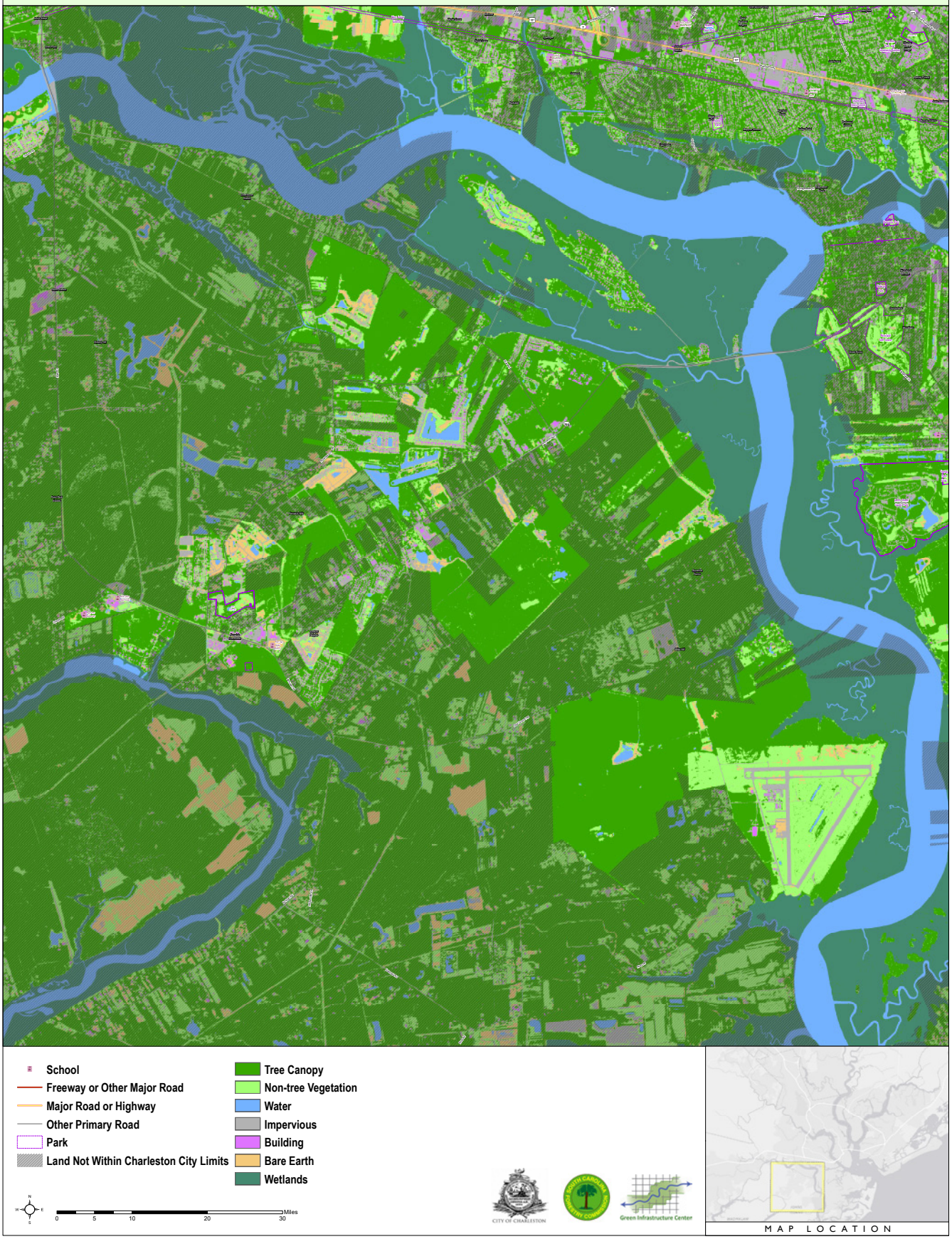
Trees Require Care to Thrive

In urban environments, many trees do not survive to their full potential life span. Factors such as lack of watering or insufficient soil volume put stresses on urban trees, stunt their growth or reduce their lifespans. For every 100 street trees planted, only 50 will survive 13-20 years (Roman 2014). Much of this mortality is due to choosing the wrong species, lack of watering as trees establish, and overly small planting areas or even storm damage. This means that, care and attention to good planting practices, tree care and maintenance and adequate standards are critical in order to protect and realize the advantages of a healthy urban forest. In addition, it is important to recognize that an older, well-treed neighborhood of today may not have good coverage in the future unless young trees – the next generation – are planted today.

In urban areas, tree canopy should be assessed and realistic goals established to maintain or expand it. GIS can be used to model how many trees might be fitted into an urban landscape. A Possible Planting Area (PPA) map estimates areas that are feasible to plant trees. A PPA map helps urban areas set realistic goals for the urban forest.

As urban trees age and die, they should be replanted to ensure the many benefits trees provide continue.

Land Cover: Johns Island



A map of land cover can be created to show which areas are well treed as well as areas where more trees may be needed. GIC created this map of John's Island in Charleston South Carolina to help the city calculate the stormwater uptake benefits provided by the urban forest.

Research for this guide identified twenty-eight specific actions and strategies that were currently being applied to urban forestry programs in South Carolina. (See Table 3.1). For further details, contact the localities involved.

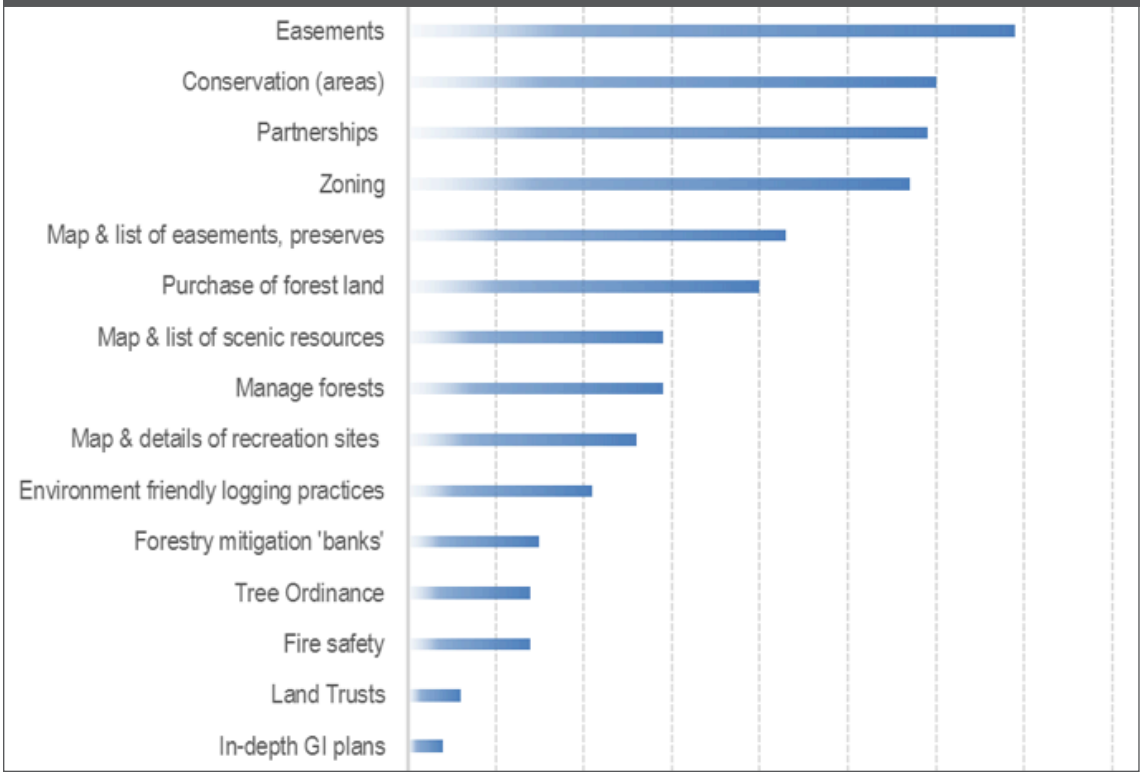
Protecting Forests

Protecting forests was mentioned in the comprehensive plans of 29 out of the 30 localities surveyed (97%) for this guide. There are an extensive number of these tools, and widespread concern shown by localities to protect their forest cover, in large part because of the economic benefits bestowed.

TABLE 2.1: STRATEGIES FOR URBAN FOREST MANAGEMENT

ASSESSING BENEFITS	TREES AND ROADS	STORMWATER MANAGEMENT	LANDSCAPE PROVISIONS
Urban Forest Management	Downtown revitalization	Reducing stormwater cossts	Landscaping Ordinance
Economic benefits	Entrance corridor protections	Urban floodplain protection	Canopy goals
Property value benefits	Street and lot design, beautification	Reducing impervious surfaces	Replanting program
Wildlife benefits	Trees in county or city facilities	Hydrology changes	Trees in Parks
Quality-of-life benefits	Tree preservation ordinance	Low impact development	Trees Outside Forests
Reducing contaminants and pollutants			Education/Stewardship programs
Reducing emissions and power use			

TABLE 2.2: STRATEGIES FOR PROTECTING FORESTS



3 How to Include Forests in Comprehensive Plans

The South Carolina General Assembly authorized municipal planning and zoning in 1924; and in 1942, it enabled county planning. In 1967, the Comprehensive Planning Act authorized county governments to create local planning commissions, as well as joint city-county planning commissions. Counties were thus authorized to undertake planning, zoning, and subdivision regulation within their boundaries. The county planning commission was authorized to prepare, maintain and implement a local comprehensive plan. Planning controls, such as zoning, were to be used to guide growth and promote planned, orderly land development. For the ordinance text please see: http://www.scstatehouse.gov/code/t06c029.php Although by statute, comprehensive plans should be reviewed at least every five years to determine if changes are needed in any areas of the plan, this does not always happen in a timely manner and information in the plan may be out of date or not reflect current priorities.

The key required comprehensive plan elements are population, economy, natural resources, culture, community facilities, housing, land use, transportation, and priority investments. The Natural Resources element is where the locality should review and plan for agricultural soils, forests, key habitats, parks and other open spaces, scenic areas, watersheds and their rivers and streams, lakes, wetlands, beaches and dune areas, flood plains and floodways, locations of minerals, air quality, *etc*.

Although forests may be discussed within the natural resources section of the comprehensive plan, it is important to consider the impact on forestry on *all of the elements*. In this chapter we discuss the essential elements of the comprehensive plan and how they should address forests and other habitats. We conclude with a summary of key policies to consider within the comprehensive plan as well as for implementation of comprehensive plan goals.

Forests provide key wildlife habitat, water filtration and recharge, scenic vistas and slope stabilization so knowing the location and extent of forested landscapes is key. In rural areas, the green infrastructure model can be used to locate the most significant forest habitats. In urban areas, an urban canopy assessment can show the extent of forest cover. See the Darlington County case study for examples of how forest habitat cores are indicated or the Summerville Plan for an urban example (see resources and case sections of this guide).

Many aspects of planning impact the rural and urban forest. So, what is the locality's overarching policy towards its trees and forests? Are there special areas of forest it wishes to prioritize, or particular interests and activities it wishes to promote and protect? Are forestry-related jobs important to the area or not? Does the locality wish to make improving the health of its forests a priority? Or protecting its clean drinking water? Or flood mitigation? Are major new housing developments and roads planned – in which case, what role can trees play? People often consider the role of trees in adding natural beauty but they can do so much more! Trees can serve a significant role in noise reduction and improved leisure opportunities for new residents, uptaking stormwater and cleaning surface waters, removing harmful chemicals from the air and sequestering carbon.

When a comprehensive plan is drawn up, a holistic, overall strategy should be employed for addressing all issues, not just forests. But in the case of forests, taking a piecemeal approach can have serious consequences, resulting in contradictions and conflicts between departments, one of whom might wish to save a particular tract of woodland, wetland, or forest, the other that might see it as an inviting housing project or the best route for a four-lane highway.

Sunset over Lake Marion in Berkeley County SC. Forests help protect the quality of the water.

What role can trees play? Are they merely decorative, or could they serve a significant role in noise reduction, creating inviting parks, improved leisure opportunities for new residents, or helping bring jobs to the area?

Economic Development Element

Forestry-dependent job sectors, such as logging, milling, furniture making and wood crafts, should be mentioned in this section as should the economic impact of tourism, hunting, fishing and birding, or mountain biking. Such leisure activities within forests can create thousands of related jobs, from guides, sport shops, bed and breakfast establishments, restaurants, boating equipment suppliers to campsites and RV parks.

Research for this guide identified several specific areas of job potential related to forests, other than timber and wood products, or the leisure and tourist industries. For example, some companies find well-managed natural areas, such as forests, a major draw for their employees, and so are more willing to locate in areas with forests that can be used for leisure activities, including forested parks and lakes, trail systems and greenways. Property values are noticeably higher in areas with access to large forests. See sidebar.

Having a park within 1,500 feet of a home increased its sale price between $845 - $2,262 (in 2000 dollars). The larger the park, the more significant the property value increase. So parks equal a better tax base!

Large natural forest areas have a greater positive impact on nearby property prices than smaller urban parks or developed parks such as playgrounds, skate parks or golf courses. So bigger intact forests/natural areas equal more revenue!

Economic Benefits of Recreation, Open Space, Recreation Facilities and Walkable Community Design, 2010.

THERE CAN BE SUBSTANTIAL ECONOMIC LOSSES ASSOCIATED WITH REMOVING FOREST COVER, SUCH AS:

- loss of valuable timber land
- loss of topsoil, increased stormwater runoff and flooding
- loss of associated wood products jobs
- decline of timber-based towns, with associated loss of stores, young people, and so on
- decline in urban areas that lack city parks or pleasant tree-lined streets
- increased noise and pollution, especially along major highways and in urban areas
- housing developments are less appealing, and it is harder to sell units
- if marshland or rivers are effected, substantial loss of fish nurseries and stable sea barriers
- reduced cleanliness of drinking water, leading to increased filtration costs

When it comes to actions that South Carolina localities are already taking to utilize forestry for economic gains, a selection of them are listed in Table 2.1. Of the 30 localities surveyed, 27 mention the economic benefits of forestry (90 percent). These include a wide range of tools, some of which localities identified as:

TOOLS FOR REALIZING ECONOMIC BENEFITS	LOCALITIES
State and federal programs	14
Farm and ranch protection programs	10
Forest Stewardship Program	10
Best Management Practicess	19
Restoration programs	10
Scenic River Program	7
Wildlife Habitat Incentives Program	5
Forest Land Enhancement Program	1
Forest legacy programs	2
Private investment	6
Promoting agri-tourism and eco-tourism	10
Development impact studies	9
Recreation needs assessment, master plan	10
Open Space Plan	14
Greenways, trails, rail trails and Blueways	21
Neighborhood Master Plan	4
Capital Improvement Plan (CIP)	3
Protect steep slopes	5

See Appendix C: Tables of Results for an expanded list.

Cultural Resources Element

It is often hard to separate cultural resources from the environment. An historic house or battle field, an historic district or Native American archeological site is inevitably set within a landscape that partially defines its character. With important historical monuments, visitors come to appreciate the surrounding views and the setting of the site within an historical and environmental context, which includes woodlands, trees, and forests. If they are on a heritage tour, they will likely wish to visit state forests and parks *enroute*. And we should also note that, especially in South Carolina's lowlands, individual trees of great age, draped as they are in epiphytes and Spanish moss, are often viewed as historical, cultural elements in their own right. It is why several localities in the state specifically protect trees over a certain age and caliper. Perhaps the best-known heritage tree in South Carolina is the Angel Oak in Charleston, estimated to be hundreds of years old. It is 66.5 feet tall, and 28 feet in circumference, producing canopy shade of around 17,200 square feet. From tip to tip, its longest branch is 187 feet. For more large tree facts see the tree registry maintained by Clemson University https://www.clemson.edu/public/champtree/

Other tools that help protect treescapes connected to the state's cultural heritage sites include: granting easements to landowners to preserve their trees, land purchases, purchasing development rights, and working with local landowners and businesses and zoning – many of whom will have a direct interest in preserving the character of an historical site or district, since their own jobs and prosperity often depend upon the number of visitors.

Additional techniques that can be used to preserve cultural heritage include focused development, managing growth and reducing development pressure on specific sites. Re-use of existing infrastructure and buildings also help maintain established forestry and scenic values. Currently, nine localities mention the SC Heritage Trust Program in their comprehensive plans, which are less than a quarter of those surveyed – so there is opportunity for much more to be done. See the GIC's *Evaluating and Conserving Green Infrastructure Across the Landscape: A Practitioner's Guide* for more information about how landscapes support historic and cultural features.

TOOLS IDENTIFIED FOR PROTECTING FORESTS	LOCALITIES
SC Heritage Trust Program	9
Easement programs	21
Partnerships with local landowners and businesses	19
Zoning agricultural/forestry districts	15
Purchase of forest land	12
Purchase of development rights (PDRs)	5
Tree ordinance	5
Land trusts	2
Conservation areas	21
Forest Legacy Program	2
Restoration programs	10

Forests, woodlands and urban treescapes can have significant historical and cultural value of their own. Trees are often associated with key events in our country's history, such as Johnny Appleseed planting thousands of fruit trees. Orchards provide hundreds of jobs and often have cultural significance. The trees around and leading up to plantation homes contribute to their historical character. In some areas the allees of trees linking old entrances are recommended for protection.

The Angel Oak in Charleston South Carolina is thought to be hundreds of years old. It has both ecological and cultural value..

This allee of trees, which once led to a plantation, is both an ecological and an historic asset.

Community Facilities Element

In many small rural localities, local government facilities, such as courts, county office buildings, libraries, schools and wastewater facilities provide many of the jobs in the area and often occupy a large area of land area within the county seat, especially in the heart of town. As such, treescaping parking lots, sitting areas, sidewalks and parks within what may be an extensive complex of buildings can transform a hot, bare, uninviting prospect into one that is cool, shaded and inviting, in which buildings use less energy, staff can enjoy their lunches in the shade, and clients feel more welcomed.

School grounds, often with extensive sports fields, can plant trees to provide shade for spectators, parked cars, walkways and bleachers, as well as provide natural learning experiences for children who can be taught how to tend trees as part of a natural landscape. Children's capacity for learning dramatically improves with exposure to just 15 minutes of nature each day. There are grants available for education programs that involve developing outdoor learning options such as outdoor classrooms, school arboretums and other options. Community centers, bus stations and emergency services buildings can also be encouraged to plant scenic trees, in order to add to the overall pleasing aspect of the town for visitors and residents alike.

Of the localities surveyed for this guide, 8 currently include volunteer programs in their comprehensive plans, 19 include education programs, 9 use scenic designations, and 17 use tools to design development and 10 reuse existing infrastructures, including buildings. All these methods have the potential to either save treed areas from destruction, or to plant new trees in the heart of the urban area. Trees in Parks programs are utilized by 12 localities currently. And 12 local authorities specifically mention forestry as a community asset.
Note: The community facilities element must be adopted before adopting subdivision or other land development regulations. S.C. Code § 6-29-1130(A).

Housing Element

Coordination with the goals and strategies of the housing element mainly involve the siting of housing developments and their supporting infrastructure, such as roads and sewage services. In the south, such development often results in the fragmentation of core forest habitats, causing extensive impacts on wildlife, hunting and fishing. However, there are methods of low-impact development and clustering of housing units that help preserve woodland within and around such developments. Trees are welcome noise buffers from nearby roads and provide shaded sidewalks and recreation areas for residents and their animals, as well as woodland trails, stream buffers and other environmental benefits that promote the health and well-being of residents.

While many localities have rules for buffering parcels from incompatible uses, trees can and should be employed throughout the development to do far more than just buffer.

Many housing developers are recognizing the benefits of maintaining woodland in their developments and of the increased prices they can ask for such benefits. Homes near green spaces sell faster and for greater profit than those further away.

Local authorities can ensure that tree cover and the treescape are included in all such plans through both zoning regulations and by making specific mention of forest requirements for all new housing developments. Developers can also be encouraged to use offsets, whereby they purchase an equal area of treed landscape for the locality in exchange for destroying forests as a result of a development.

Other tools used by localities to mitigate the effects of new housing developments include:

TOOLS TO MITIGATE DEVELOPMENT PRESSURES	LOCALITIES
Density bonuses	12
Managing growth	28
Infill development	12
Focusing development	22
Designing development (including cluster dev.)	17
Reuse of existing infrastructure	10
Easement programs	21
Partnerships with local landowners and businesses	19
Zoning agricultural/forestry districts	15
Developer incentives	16
Conservation funding for forests	7
Policies for protecting streams/riparian buffers	6
Incentives, grants for recreational features	6
Dowtown revitalization	5
Trees outside forest	1

The property value benefits of trees are recognized by nine localities in South Carolina: Quality of life benefits acknowledged by 13; 7 localities have canopy goals; 7 have Urban Forest Management Plans; and 8 mention tree preservation or have a Tree Preservation Ordinance.

Transportation Element

Transportation plans are based largely on where population growth and employment opportunities are projected to occur. However, roads are also built *before* development occurs, sometimes as an incentive to growth. As such, transportation policy can have a significant impact on forestry, as well as on many other elements of a comprehensive plan, since roads can fragment habitats, add to noise and pollution, and allow more invasive species to infiltrate nearby forests, impact water flows and quality.

A map of habitat corridors can help show which areas should be avoided to reduce negative impacts to the locality, it residents and its natural assets. The SC green infrastructure guide (see Resources Appendix) describes how to locate key habitat cores and corridors for wildlife. Roads can be designed to allow animals to pass under them, from large mammals such as black bears, to smaller critters such as spotted salamanders. However, the best solution is to channel development to where it can already utilize existing roads and infrastructure as well as facilities such as schools or wastewater treatment plants. This approach maximizes use of existing infrastructure and reduces the costs of maintaining those services. If areas are already fragmented by roads, consider mitigating those impacts by replanting a key wildlife corridor or restoring a degraded wetland. A green infrastructure strategy can be used to inform those decisions.

Entrance corridors can be planted with attractive trees along their edges and in their medians to reduce noise and pollution and protect neighborhoods from excessive traffic encroachments. Bypassing wetlands, or coordinating with forestry and fishery agencies, can mitigate the effects of causeways, bridges or roads through those areas, providing adequate conduits for water flow into and out of tidal areas and riparian systems. Such policies not only protect wildlife, but also protect surface waters from runoff of oil and other chemicals. Providing substantial woodland buffers along roads also shelters wildlife from noise and effects of pollution. Additionally, if a road must be put through an historic view shed, then planting trees can greatly reduce both the unsightliness and impacts from noise.

These are among many of the strategies and tools currently used by localities in South Carolina. In practice, transportation authorities such as South Carolina Department of Transportation (SC DOT) take many of these matters into consideration when planning new roads and welcome public input on potential impacts and how to mitigate them. Unfortunately, habitat maps may not exist when road projects are planned. This is why planning for green infrastructure – both existing and future – should

happen before transportation plans are decided. Since coordination (notification) is required with adjacent and relevant jurisdictions and agencies that would be affected by transportation projects, localities should consider coordinating their policies on natural resources, including forestry, with each other as well.

There may be opportunities to work with SCDOT on habitat restoration projects through their mitigation bank. The bank is in the planning stages, and when fully developed will help SCDOT mitigate the impact of road projects. Given that the SCDOT needs to find habitat restoration project to mitigate the impacts of road projects, including a green infrastructure strategy in the Comprehensive Plan can easily and quickly identify which areas can be better restored or protected and marketed to SCDOT for mitigation areas.

Priority Investment Element

When it comes to this element, those federal, state and local funds available for public infrastructure and facilities could include forestry and tree planting programs among those projects that a locality plans to fund.

Land Use Element

This element controls the development characteristics of the land, including existing and future land use. One of those uses is 'forestry', and yet not every locality with active forestry even mentions it as part of its land use strategy. Land use, in many ways, brings together many of the other goals set by a locality and determines where it wishes to direct development and whether and how it wishes to control it. As such, the findings, projections and needs addressed in this section should tie back into those needs highlighted in all the other elements. For example, if the Community Facilities section identified the need for more parks and natural resources in areas at risk of development, or that were particularly sensitive development impacts, such as a natural dune system, then the Land Use section could highlight areas that should be conserved as green space or protected lands. It may also suggest open spaces in areas where the population lacks access to parks or suggest conservation uses in areas most suited for rural economic uses such as forestry. As noted, a good way to begin this is to include a map of intact cores and corridors within the comprehensive plan by utilizing the SC habitat cores model and evaluating key habitats (see example from Darlington County on page 40).

It is possible to define many specific ordinances to protect forests and trees as part of land use policy, especially if preserving the landscape or quality of life for residents are priorities. Note: "The land use element must be adopted prior to adopting a zoning ordinance." S.C. Code § 6-29-720 (A).

Natural Resources Element

The Natural Resources element is the key element of a comprehensive plan where a locality's overarching strategy, priorities and goals with regard to its forest lands, including woodlands, wetlands and parks, should be presented as a consistent and holistic plan. Here, the needs of forests can be balanced with those of farmers and other land users, as well as with the requirements of other natural resource uses, such as extraction industries.

Obviously, many of the methods and tools mentioned in the previous elements apply here. But, in addition to those, here are several more that are currently employed by localities surveyed in the research for this guide:

TOOLS TO ENHANCE NATURAL RESOURCES	LOCALITIES
Wildlife management programs	8
Habitat protection	29
Endangered species	20
Riparian buffers	22
Connection corridors	16
Mitigating or preventing fragmentation	8
Planting native tree species	6
Removing invasives, non-natives	3
Wildlife Conservation Plan	7
Wildlife Habitat Incentives Program	8
Providing the public with a list of acceptable tree species	2
Watershed Protection Overlay District	4
Water quality buffers	15
Wetland protection ordinances	18
Protection of steep slopes	5

Specific Threats

It is important to discuss and consider specific threats to forest cover, such as development, roads, changing land ownership, fire, air pollution, poor logging practices, fragmentation, invasive plants and disease. By consulting with the state foresters, a locality can determine ways to prepare for and mitigate against such threats; tools such as the purchase of development rights (PDRs), transfer of development rights

(TDRs), Best Management Practices (BMPs) and creating an Inventory of Natural Resources.

There are a wide range of management tools available, including the:

- Forest Stewardship Program
- Forest Land Enhancement Program
- Forest Legacy Program
- Restoration programs

If there is a board responsible for any of these sectors, it should prepare this element (for example, if there is an urban forest commission, it should prepare any statistics, trends and recommendations on the condition and extent of the urban forest). Note: The use of standing advisory boards for preparation of this materials is covered by S.C. Code § 6-29-510 (D) (3) "If the locality has a tree commission, they should be actively engaged in setting these goals."

Following is a chart of possible policies, associated goals, indicators and examples of where they are in use. This is not an exhaustive list. However, it contains the essential elements necessary to consider including or expanding for effective landscape conservation or restoration.

POLICY SUMMARY			
LANDSCAPE PLANNING TOOLS	GOALS	METRICS INDICATORS	SC EXAMPLE*
Transfer of development rights (TDR). Move rights from sending zone (rural) to receiving zone (urban/growth area). **Purchase of development rights (PDR).** Purchase rights to allow uses to continue but restricts new development.	Protect high quality natural landscapes from fragmentation by over-development. Protect rural landscapes and land uses.	Establishment of sending and receiving zones. # of development rights transferred away from rural areas Acres of high value rural land protected	TDR: Town of Bluffton Greenville County Beaufort County PDR: Beaufort County, SC Chapter 94
Conservation easements	Protect land use in perpetuity for scenic, agricultural, forestall, wildlife or other values. Create a network of protected lands.	Acreage of highest valued lands protected (suggest basing this on maps of habitat cores and high value ag soils)	Richland County Charleston County
Urban Growth Boundaries	Channel growth to areas with services and protect sensitive or productive rural lands.	Maintenance of growth boundary (minimal expansions/exceptions). Majority of new growth within the boundary.	City of Charleston
Conservation Districts	Provide additional restrictions on land uses to protect sensitive, natural or scenic areas. Protect safety by preventing development in flood prone/ hazard areas. Protect historic resources. Provide open space access/ recreation.	Number of acres protected or restricted. Lack of frequent variances. Inclusion of key natural resources within the districts (use of maps to inform district boundaries).	Oconee County Berkeley County Sumter City/County
Riparian buffers	Protect open water from adjacent runoff and improve water quality.	Number of miles of shoreline protected. Lack of infractions. Improved water quality. Wildlife abundance and healthy fishery.	Beaufort City Richland County Lexington County Greenville
Planned Unit Developments	Requires 15-25% open space.	Percent of high value natural resources within open space.	Edisto Beaufort City Charleston County Jasper County Conway Loris Mt. Pleasant
Open Space Planning	Provide opportunities for recreation and access to nature.	Make available a list of standards that are nationally or regionally recognized based on population size. For example, 1 acre of greenspace for every 1000 people; 10 miles of greenway for every 5000 residents, etc.;	York County Edisto Beaufort
Urban planning to reduce imperviousness	Increase amount of tree canopy required. Limit areas of disturbance. Increase landscaping standards. Adopt tree protection ordinance. Provide for infill development.	Percent canopy required to be retained. Areas of open space/green space maintained. Number of trees saved from removal. Reduction in runoff. Credits for building within development area.	City of Charleston Beaufort County City of Columbia Georgetown County

*Not a complete list, merely for example.

In addition to those tools mentioned in the chart on page 23, there are other ways to dis-incentivize development in areas where it is less desired, as well as ways to incentivize it where it is wanted. **Tax increment financing** leverages a fee on new development by reassessing properties that are improved by necessary new infrastructure. This put the burden of growth on those causing or benefitting from such growth.

Impact fees are another tool applied to each unit of development (e.g. new houses) to cover costs of new road, sewer lines etc., although their effectiveness is limited as South Carolina places restrictions on their use and maximum amounts. **Development agreements** (also known as proffers) are another growth tool to offset the costs of new development and are intended to be voluntary.

P**riority investment areas** are a tool to encourage development only where it is most desired by spending funds to invest in infrastructure (roads, public water and sewer) in established growth areas.

Density bonuses are another tool to encourage development where it is most desired, such as in a downtown or close in to a city, or within a development area. One challenge with additional density is that it may generate additional impervious surfaces. To avoid that unwanted impact, Charlottesville, Virginia addressed this by offering a 50 percent density bonus for small infill developments within the downtown district, but tied those bonuses to installing additional stormwater features, such as green rooftops of bioswales to reduce runoff and improve water quality.

There are extensive resources to assist communities in choosing the most effective tools to plan better for both growth and conservation.

- Regional Councils of Government can provide guidance to localities in developing ordinances and planning for conservation or development.
- Land trusts are located across South Carolina and they also can provide help with determining land conservation priorities or establishing conservation easements.
- South Carolina Forestry Commission provides assistance for individual landowners as well as local governments or industries interested in forest conservation or management.
- Clemson University's extension service also provides resources and direct outreach and education for landowners, as well as the many excellent universities and colleges across South Carolina.

Tree Protection standards should be adopted. Localities should have standards for tree protection during construction, ordinances protecting large trees and requiring replacement plantings for unavoidable losses, adequate standards for tree planting (e.g. 1000 cubic feet of soil volume per tree) and processes and standards for inspecting trees post construction to ensure they remain in place and are well managed. Trees found to be damaged should be replaced. Maintenance can be required as part of the development approval so that trees do not die in the first few years due to lack of care. For more on this see the resources in the Appendix, especially, Planning for The Community Forest in South Carolina. The Trust for Public Lands also has a variety of tools to assist with analyzing open space requirements. See the Appendix.

Case Example of Plan Language: The Comprehensive Plan for Fairfield County, SC.

Fairfield County is located in the Upland Piedmont region of South Carolina. It is a very small locality, at just 710 square miles, with a population of only 22,747 (2015 estimate). Eighty six percent of that area is under woodlands, not including urban forest contained in the county's two municipalities. About three percent of the forested land is in public ownership. The largest is the Sumter National Forest in the northwestern part of the county. Private ownership of forested land in dominated by corporations, individuals and the forest industry. Only six percent of the county's forested land is owned and managed by farmers.

The county's comprehensive plan states that it is dedicated to providing a sustainable quality of life in a "green" physical environment characterized by:

- A balanced physical form consisting of urban and community clusters, farmland, woodland, open space, and outdoor recreational opportunities
- Attractive land development.

It describes its goals as intending to:

1. Articulate an arrangement of land uses which will promote land use compatibility, protect property values and environmental resources, and accommodate future development in an orderly manner.
2. Enhance the quality and appearance of development and physical settings.
3. Conserve and effectively use natural resources.

They note that the value of the county's forest and forest products cannot be overstated, since forest products contribute substantially to the local economy.

For rural areas of the county, the plan notes that forests are essential to:

- clean air
- clean and abundant water
- wildlife
- many natural cycles
- outdoor recreation

For urban areas of the county, the plan notes that forest canopy is essential to:

- protect and enhance property values
- control erosion
- moderate climate extremes
- provide screens and buffers
- promote traffic safety
- contribute to community ambience and beautification.

The plan suggests that, in urban and urbanizing areas, regulating and monitoring the care and cutting of trees on public rights-of-way, as well as private property, is recommended as a means of protecting and enhancing the environment.

The county utilizes USDA data to review land use classes, the results of which can be seen in the Table below:

FAIRFIELD COUNTY FOREST INVENTORY		
CLASSIFICATION	ACRES	% OF COUNTY
National Forest	11,560	03
Forest Industries	130,622	30
Farms	27,054	06
Corps/Individuals	211,920	48
Totals	381,156	87

USDA, Soil Conservation Service, Forest Statistics for SC: US Census of Agriculture, 2007.

Example Goal Strategy From Fairfield's Comprehensive Plan

Goal 3: Conserve and effectively use natural resources. Conservation of natural resources, including historical resources, is essential to the retention of quality-of-life characteristics.

- **Action:** Educate the public, property owners, and developers on the aesthetic, social, and economic importance of natural resources, and the need for their conservation.
- **Action:** Amend the Land Development Ordinance to encourage developers to incorporate natural and historic resources, where such resources are proposed for development, into development projects to uniquely signature such projects and conserve resources in the process.
- **Action:** Identify and map the location, nature, and extent of all existing and potential resources to be conserved, so that developers and property owners can mitigate or adjust development plans to avoid or incorporate such resources into the planning and development process, providing for responsible utilization as a means of conserving them for present and future generations to enjoy.
- **Action:** Promote cluster subdivisions with design features such as open space, greenways, wildlife corridors, wetland preserves, farmlands, etc. as a means of enhancing development, conserving resources, and maintaining a balanced environment.
- **Action:** Amend subdivision (development) regulations to require resource conservation as a requisite to site development.
- **Action:** Amend development regulations to require the use of Best Management Practices (BMPs) in dealing with the development of resource areas.

Conservation of natural resources, including historical resources, is essential to the retention of quality-of-life characteristics.

In the next section, how to obtain and use data for goal setting is described. Good goals begin with good data.

4 Good Comprehensive Plan Strategies – Start With Good Data

As this guide discusses, comprehensive plans may include overarching or somewhat vague goals that lack clear strategies for how to achieve them. As leadership, especially elected officials, change over time, clear policies within the comprehensive plan can provide continuity and a clear vision for the future. Since the comprehensive plan is used to inform growth, development and conservation, as well as to give direction for spending under the Capital Improvement Plan (CIP) and to provide the legal basis for zoning decisions, it should be clear, data rich, informative and strategic.

Appendix B of this guide includes a format for how to create a complete strategy. It is formatted as a worksheet to provide a handout to copy and work with local committees. Determine how specific the local comprehensive plan has been or will be. If the plan has been overly vague in the past, consider recommending that it be made more specific. The following are specific goals and related actions provided as examples.

TIPS FOR AN EFFECTIVE STRATEGY

- Goals should be informative and explain the reason for something: what are you doing and why does it matter?
- Objectives should support the goal. How will the goal be achieved? Objectives should be measurable. One should be able to tell if it was done or not. So don't only say "Plant more trees." Instead try, "Plant 1000 more trees annually to achieve the 10,000 tree goal by the year 2030."
- Actions may be listed under objectives to explain how they will be done, e.g. create a possible planting area map, allocate funds for tree purchase and care, hire a summer tree care crew etc.
- Funding levels can also be denoted; this will help when budgeting time comes around to ensure these dollars can be included in the Capital Improvement Plan (CIP) or raised from grants or other sources.
- Set a timeframe for achievement. Even if the timeframe is, within the next five years, it will allow future planners and leaders to know when to expect action and how to tell if the strategy was achieved. This allows the Comprehensive Plan to be an actual ***plan*** rather than just a wish list.

How to Evaluate Forests and What to Include

The research conducted for this guide has shown that forests are often overlooked in comprehensive plans. Localities may lack recent tree data or not relate healthy forests to the success of the community. In some cases, trees may be considered as a Parks Department concern, or something best left to forestry agencies at the regional or state level. Even if a study of forest resources has been conducted by a locality, it may not make its way into the comprehensive plan.

In an attempt to remedy this, this chapter reviews those types of data necessary to adequately assess the extent of forests, woodlands and urban trees, and provides options for how localities can obtain and include forest information. Most importantly, this section discusses how to use that data to build strategies, define goals and specify actions.

Mapping Natural Landscapes

As noted earlier, South Carolina has a model of intact natural landscapes that can be used to generate maps of key habitats at

the landscape scale. It requires GIS software to run the model and is intended for use over large areas, such as counties or regions, as it includes large, unfragmented forests and wetlands. It is not intended for urban areas where habitats are much smaller and not likely to show any large, intact landscapes. The guide for using this data is found in the Appendix.

Urban and suburban areas should consider creating an urban forest canopy map that shows the extent and condition of its urban trees (or utilize a recent canopy map). Oftentimes, even communities that set goals for their urban forest canopy, don't reflect what is actually possible. For example, cities may have set a goal for urban forest canopy without knowing their current canopy level. So, as noted in the prior section, start with good maps and statistics before beginning goal setting. One exception to this rule is; if the need is to create a plan, a goal may include evaluating canopy or updating a landscape habitat map. But whenever possible, take the time to create data first to inform goal setting.

What To Evaluate for Urban and Rural Areas

This section discusses the different needs of urban and non-urban areas. There are different scales of analysis for cities versus rural areas, since land cover types will vary. And most localities have to develop strategies and goals for both types of tree cover. Many cities have suburban and rural lands within their boundaries, while all counties contain developed towns, and some have extensive pockets of dense suburbia within their boundaries.

Because of this, the types of data required are different for rural and urban areas. Rural areas need more information about large intact landscapes, areas important for forestry, or vast areas. As the types of land uses and land cover within a small area are less diverse, e.g. a forest may cover hundreds of acres with occasional homes, a finer-grained scale for analyses is less important for setting broad goals such as, which areas to set aside for forestry or conservation. In an urban setting, if the resolution of the data are too coarse, it may miss key trees or underestimate tree canopy. When using imagery to analyze land cover, for urban areas, one-meter resolution or better is necessary, while for rural areas, 30 meters resolution is usually good enough to detect land cover types or significant change at a county scale. Some areas also have LiDAR which can help provide additional fine grained detail for discerning between a bush and a tree.

Urban Areas

The scale of analysis needs to be much finer grained for developed urban areas than for rural areas. Usually, environmental features in cities or suburbs consist of woodlots and forest patches, individual street trees, small parks, riparian corridors, trees in public areas, such as on school grounds and around administrative buildings, and yard trees. There will be different considerations for tree care and management based on whether it is on public or private lands. For street trees, the identity and health of each tree may be evaluated, versus backyard trees which cities don't monitor or maintain.

SOME CONCERNS THAT ARE MORE IMPORTANT FOR URBAN AND SUBURBAN TREES:

- Interference with power or phone lines as well as underground utilities
- Tree roots upheaving sidewalks
- Branches overhanging main streets (a positive for shade but potentially a problem if interfering with traffic)
- Trees in medians and around government buildings
- Ensuring public safety from falling limbs and large roots
- Removing diseased limbs; treating for pests
- Replanting

Generally, for cities and suburban areas, the most important data for creating a strategy and specific goals is to know the location and extent of the urban forest. Tree canopy data show how much of a city is covered by trees. Knowing the percentage of tree canopy across the city can be used to inform how well the canopy supports key city or town goals, such as keeping the city cooler, providing attractive areas, uptaking stormwater, filtering runoff, or cleaning the air of volatile organic compounds (VOCs) and particulate matter that cause air pollution. Knowing the percentage of tree canopy sets a key baseline needed to establish goals and track progress.

Another important data set is to collect information on individual trees, on a one-by-one basis. This may seem a daunting task, but there are many people who could volunteer to record the GPS location, type and size of the trees in their neighborhood. Without volunteer programs, collecting such detailed information is very expensive for local governments. But with a willing university, tree steward group or neighborhood association, under the direction of experienced foresters, such a survey could be completed in one or two days. For example, eight South Carolina localities relied on volunteer programs for achieving some of the work in their comprehensive plans.

Keep in mind that even if data have been collected, this may not be apparent. Tree canopy and inventory data may reside in the Parks or Public Works Departments and not have been shared widely. On the other hand, the data may be too old to utilize for current planning. So another key step is to determine whether the locality has conducted an urban forest assessment (canopy, tree inventory, random plot sampling) in the recent past. If there *are* usable data, determine if the data can be used for goal setting. If it *can* be used, the next step is to analyze what data are missing. If volunteers can help with filling those gaps, or updating information, initiate those programs and integrate the new data.

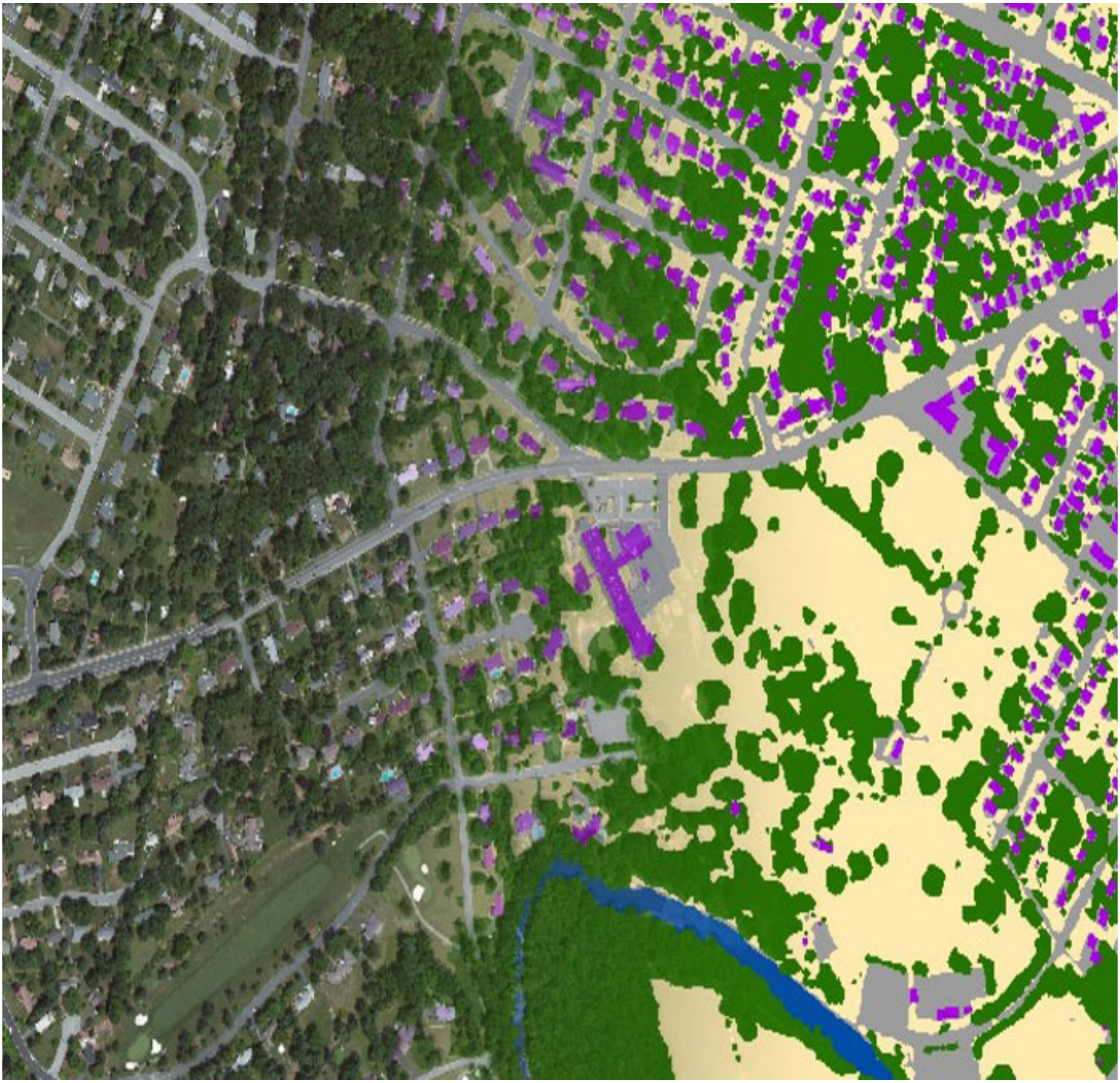
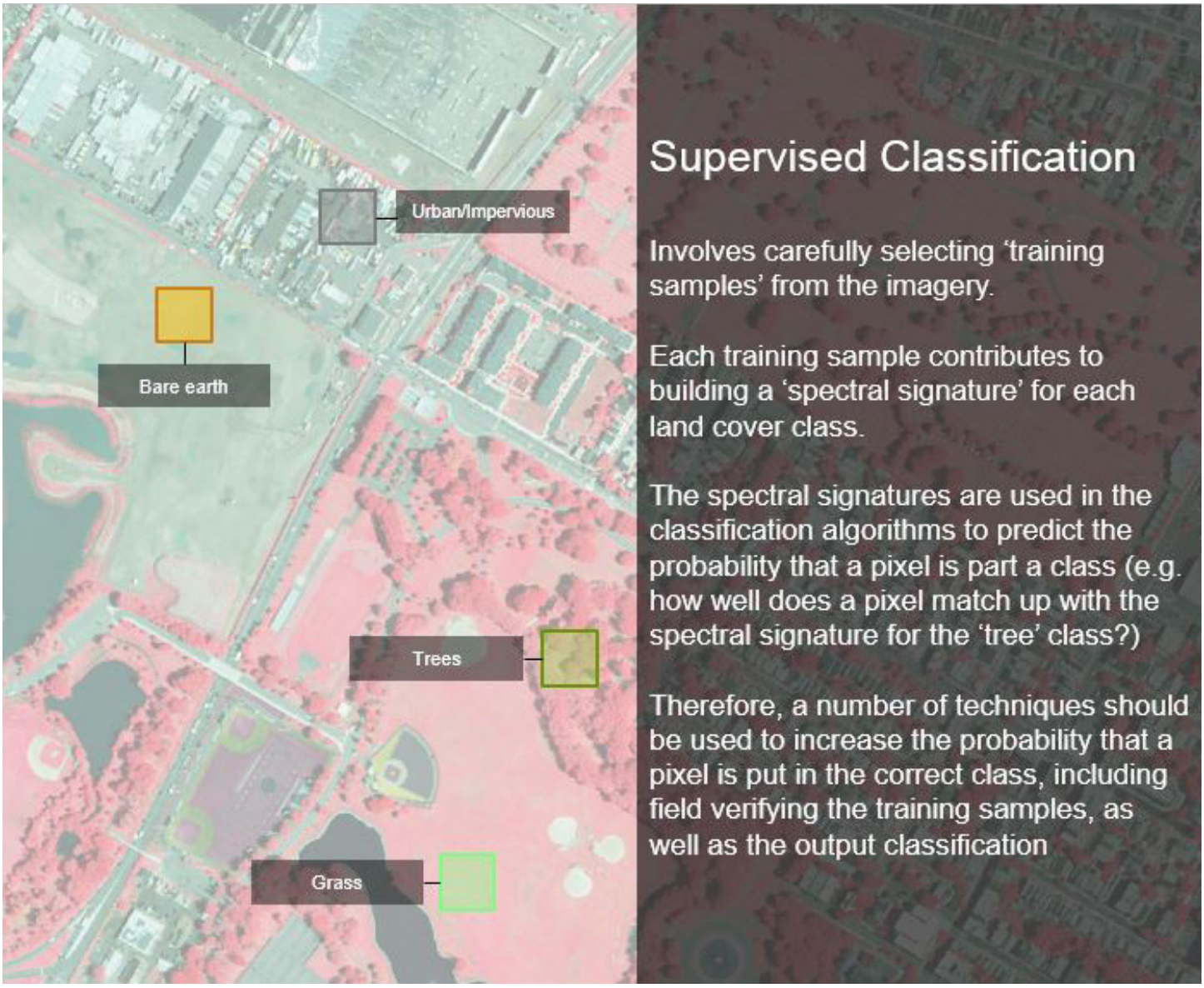


Image Classification

Image classification is the process of breaking an image into discrete 'classes.' The most common application is the identification of land use classes (urban, agriculture, forest, *etc.*) While the main purpose may be mapping tree canopy, image classification can (and should) be used to provide other land use classes, including impervious surfaces, bare earth, and so on. These data help find areas such as bare earth, where new trees could be added. They can also be used for runoff calculations, to determine where flooding might occur from impervious areas.

Image classification requires skilled analysts and specialized software. It also requires performing some quality assurance to check if the data are accurate. This is known as *supervised classification*. The process selects known areas and tests them against the digitized land cover to ensure that the software is identifying the land cover correctly. Additional quality assurance can be conducted by field-checking, to confirm that what the software classified as bare earth is indeed bare earth. Volunteers can also help with this field checking of data accuracy. An example might be a Christmas tree sales lot that showed up as forest patch, when it was simply a temporary land use and not an actual forest. The GIC created a canopy map for Summerville to use for determining the extent of its urban forest.



TREE CANOPY CONSIDERATIONS:

Data age: If the data exist, are they too old to use? For example, in a rapidly growing community, data older than five years is probably too out-of-date to prove useful. Land that was once tree covered may now be 'mall covered.'

Data resolution: If the resolution of the data is too coarse, key areas may be missed or canopy may be underestimated. Small features may be missed if the resolution is not fine-grained enough to detect key elements. For urban areas, one-meter resolution or better is necessary. If there are new LiDAR data that can also be used to further identify the largest trees.

Data quality: Even current data may be of poor quality or lack the necessary application. For example, if a locality has images of land cover taken in winter, vegetation may not be captured accurately. 'Leaf-on' vegetated land cover is needed to determine urban canopy coverage.

Calculating canopy from imagery: The USDA Natural Resources Conservation Service maintains the National Agricultural Imagery Program (NAIP) data, which shows vegetative land cover across the U.S. While it was developed for crops, images of forested land cover can also be obtained. If a locality has created its own land cover, especially if it is more recent or of higher resolution, then this should be used instead of NAIP data. But again, it must be show trees with their leaves on, so it presents an accurate picture of canopy coverage.

Obtaining accurate and good resolution imagery is only the first step. Usually, the data need additional processing to convert them from images to pixels that can be used to calculate areas of coverage.

Canopy Location and Gap Analysis

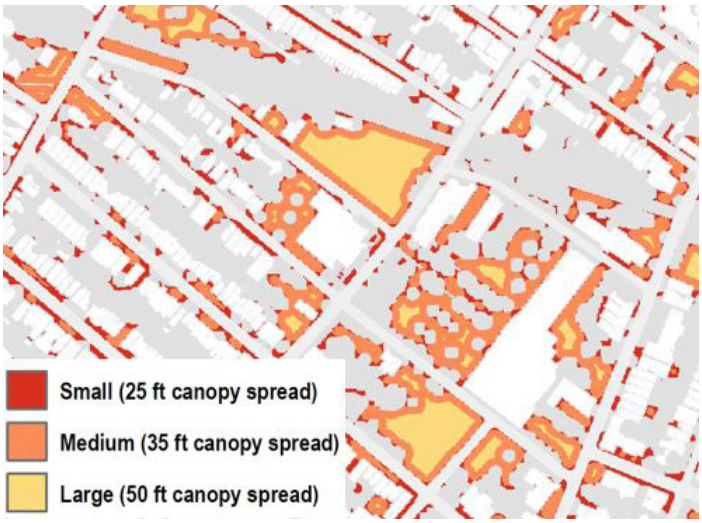
Once tree canopy is calculated, the next step is to discover where that canopy is located – and where there are noticeable gaps. For example, a city's canopy could be quite high, e.g. 50 percent of the city is covered by trees. However, it could be that the majority of the canopy is in outlying suburban areas, while the downtown has very few trees – perhaps as low as 10 percent. This means that trees may be missing from areas where they can have the greatest benefits, such as along shopping, districts and inner-city neighborhood streets.

Parse the canopy data in various ways, using GIS analysis, to learn where trees may be deficient. Locate areas of potential new planting, especially on land already owned by the local authority, such as school grounds, parks and around public buildings. Identify those streets wide enough to accommodate trees, street medians that could be planted, and entrance corridors that would benefit from some attractive trees. Contact neighborhood associations and schools and ask them where they feel more trees could be planted, and if they would be willing to help plant them. Locate streams and rivers and see if the riparian buffers are adequately treed, or need to be widened or protected from development in some way. What steep slopes does the city have that could also be treed to prevent runoff and erosion?

In particular, note where those gaps in the treed landscape prevent wildlife from easily moving through the city. Probably, residents don't want deer or bears in their back yards, but butterflies, birds, amphibians and small mammals may be welcome. Riparian corridors are good ways to encourage wildlife mobility as well as large forested patches, which enable wildlife to pass from one core habitat to another.

It is important to determine if there is enough area to plant trees before targets are set. A Possible Planting Area (PPA) analysis using GIS can be used to locate areas where small, medium or large trees could be established. This analysis can be broken out into both public and private lands. Localities will rarely meet tree planting goals without participation by private landowners. This may necessitate a tree give-away or rebate program to encourage more tree planting on private properties. It may also be that current tree planting standards are insufficient (inadequate or no planting volume standard for street tree planting wells) or a lack of funding for proper tree care and maintenance. Thus, strategies might include creating a recommended tree list, or upgrading planting standards or adding more trained staff to care for and manage trees.

A key way to build support for tree planting, care and funding is to show the multiple benefits provided. The software i-Tree Eco (see chart) allows users to quickly calculate the benefits provided by the urban forest for stormwater, air quality and other values. Even without running a model, one can find many published benefits covering the value of trees. For example, cities prone to flooding, especially those which have lost canopy over time, can justify the expense of tree planting when considering the costs avoided from flood damage. If the locality has a strong GIS team, a PPA analysis can be used to consider the future benefits of planting more trees. The image below shows how PPA was used to calculate the stormwater benefits of everyone planting one tree in citizens' yards. Also keep in mind that the urban forest may be valued for reasons entirely unrelated to the established purpose for the land.



A possible planting area analysis shows opportunities to add new trees.

TABLE 4.1: OPTIONS FOR TREE DATA AND ASSESSMENT				
CRITERIA AND DATA TYPES	STATISTICAL ANALYSIS OF A STUDY AREA'S LAND COVER	DETAILED SAMPLING OF STUDY AREA	TREE CANOPY CLASSIFYING AN AERIAL IMAGE	COMPLETE TREE INVENTORY
Advantages	Quick and inexpensive	More information than a statistical land cover analysis.	Spatial data for entire study area, including multiple types of land cover	All trees in study area are inventoried. Very useful for urban forest management, especially for tree diversity and threats.
Disadvantages	Limited data and no spatial products. Data are based on subsampling extrapolated to a large area. So while a rough overall canopy figure is obtained, it can't be used to manage trees or target areas for planting.	No spatial product for entire study area; expertise needed to collect data.	Additional information about trees is unknown. Expertise needed to evaluate imagery and use in GIS.	Usually only for trees on public land. Land cover information unknown. Time-intensive and costly.
Tools/Software	Tool creates random points on a Google Earth map, and the user quickly identifies the land cover type at each point. i-Tree Canopy www.itreetools.org/canopy/	i-Tree Eco www.itreetools.org/eco/	Land Image Analyst* free or other imagery analysis software	Professional forester or arborist can do this assessment
Result	Estimations of different types of land cover (tree canopy, impervious surface, etc.)	Estimations of tree characteristics and composition, as well as ecosystem services	Pixel-by-pixel land cover data for an entire study area; some ecosystem services can be calculated	Data on tree diversity, size, condition and possibly age (if included).

*See resources appendix for more.

Use GIS to determine areas where there are clusters of more intact urban forest cores. A good question is "How big should an urban forest patch be?" Well it depends. Bigger is better, so set a minimum size, e.g. 1 acre, a half-acre etc. This may take a little time to eyeball what are the common sizes (e.g. an acre of intact forest patch could be a lot or a little depending on what's available in the city). The forest patch itself may be better or worse quality (is it full of invasives and dead or dying trees, or conversely, does it support a rare wetland or provide a scenic area or screen an industrial area). A forest patch of 100 year old trees could be more significant than a patch of new trees or a patch of invasive species, such as a grove of non-native and invasive ailanthus!

For those communities wishing to create an urban canopy map, the USDA Forest Service has helpful tips on what is involved at https://www.nrs.fs.fed.us/urban/utc/data/ If the community also has LiDAR information, it can be utilized with canopy data to estimate tree size (small, medium and large), as well as elevation. Knowing elevations and dimensions allows the GIS analyst to refine the outputs. Knowing the sizes of trees can help to refine other estimates such as how much stormwater do the trees uptake, how much of the canopy are providing shade and other benefits. The larger the tree, the greater its value. (See *Appendix A: Resources*).

Once the canopy percent is known, it can be used to set goals. Determining a reasonable canopy percentage to shoot for is somewhat subjective. A 40 percent tree canopy would be considered as very good coverage, 10 percent as very low.

Furthermore, a city might have a high canopy percentage, but a review of that canopy may show it is in decline and likely to drop significantly, especially if there are no strategies for tree conservation or replacement. For those coastal communities subject to rising seas, periodic salt inundation and salt spray may be harming trees close to the coast and killing trees as water tables rise and inundate the roots of trees not appropriate for growing in wet or saline areas. See the Summerville case example for an urban forest map and related goals.

Estimating the benefits of planting one tree in residential yards in a neighborhood studied by GIC showed that of 47,500 parcels with single family homes, 31,000 of these had room for at least 1 tree. If everyone planted a single tree, they would intercept 62 million gallons of rainwater every year, resulting in less stormwater runoff and flooding.

One way to determine reasonable goals is to compare the city to other, similarly sized and similarly dense cities: Is the canopy percentage more, less or about the same? Avoid picking goals simply because they sound good – e.g. 25% more canopy by 2025. While this slogan is easy to remember, it may be that the city would have to plant 50,000 more trees in just a few years to reach that goal. Is this reasonable, doable or affordable? Does this number allow for trees that may be lost from storms or old age, in order to achieve a net increase of 25 percent?

Many people like to donate trees, or volunteer to care for them, but often, the funds for equipment and staff for mulching, pruning, watering are not budgeted for. In addition, some trees are less hardy, more prone to disease or wind damage, or create a great deal of debris from seed pods or large leaves, such as those from a Chinese chestnut. Choose trees that will meet city budgets, will not overstretch resources such as street cleaning, and that do not need a lot of maintenance. Also consider trees that are native – they will be better adapted to local climates and will better resist diseases. Also remember that trees that are messy – such as sweet gum – could be planted away from sidewalks so that seed pods or prickly seed cases are not an issue.

Try to make a diverse selection. Planting trees of all one species may cause havoc if a disease or pest attacks that one species, leaving entire streets or parks devoid of trees. For example, the emerald ash borer is currently affecting many ash trees across the south and is now found in South Carolina, so it may not be a good street tree choice. Other goals can be met by choosing trees that support pollinators and beneficial insects. See resources appendix.

How do

TREES BENEFIT

You?

LESS CRIME!

Apartment buildings with high levels of green landscaping have up to **52%** [2]

LOWER UTILITY COSTS!

Just 3 strategically-placed trees can **decrease utility bills** by **50%** [1]

BETTER FITNESS!

People living near greenery are **40%** more active than people in less green areas[4]

BETTER BUSINESS!

When trees are present, shoppers will spend **9** to **12%** more for products![3]

HIGHER PROPERTY VALUES!

Trees can increase residential **property values** by up to **37%** [6]

FEWER AUTO ACCIDENTS!

Street trees can **decrease automobile accidents** by **46%** [5]

LESS ASTHMA!

Childhood asthma is up to **25% less** prevalent in well-treed areas of cities[8]

COOLER SUMMERS!

Evapotranspiration can help reduce peak summer temperatures by **2° - 9°F** [7]

LESS FLOODING!

One mature tree can store **50 to 100** gallons of water during a storm[9]

LESS POLLUTION!

Mature trees absorb **120 to 240 lbs** of **particulate pollution** each year[10]

BETTER COLLABORATION AT THE MUNICIPAL SCALE

For day-to-day management, many departments may need to work better together to conserve their best landscapes. Who is involved in forestry decisions will determine the effectiveness of forest management. How arborists, urban foresters, and park managers work together is determined primarily by how a local government organizes its own departments and work force, and how lines of responsibility are established.

Parks are typically municipally owned open spaces used for either active or passive recreation, as opposed to nature preserves with more restricted public access. They may not be engaged outside of park planning, so efforts to manage forests across boundaries need to include them as well.

Planners can interact with urban foresters in integrating canopy cover and other tree-related data into GIS and analytic tools. Planning commissions can be involved in urban forestry through their reviews of and decisions about all the areas involving planners mentioned below.

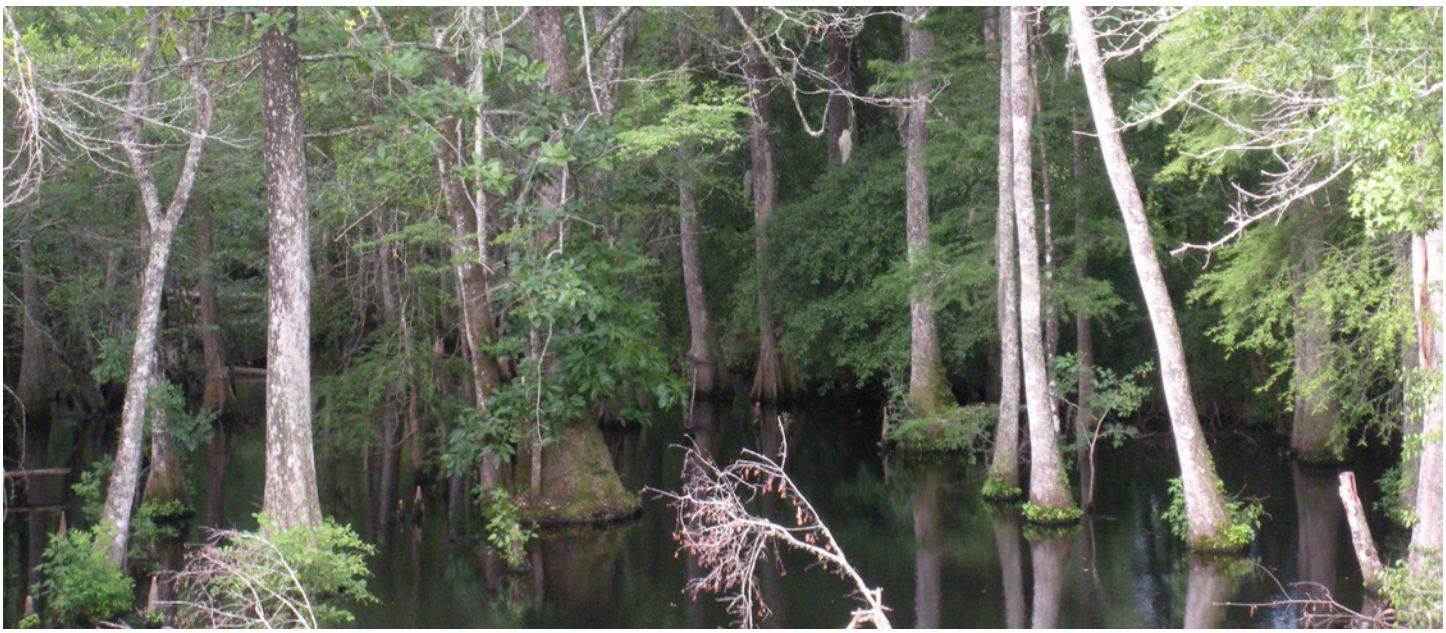
Planners, in fact, are typically in an excellent position as coordinators of input from various city departments in the review of pending development applications and overall policy development related to managing growth. For example, planners can affect:

- Requirements for detailing tree-planting plans in site plan submissions,
- Regulations regarding tree preservation procedures in the development process
- Management of tree issues arising in the public hearing process on proposed developments
- Review of site plans, which can include having an arborist check the plans for compliance on tree-related issues
- Establishment of tree-planting and tree-preservation requirements in subdivision regulations
- Development and enforcement of standards for tree planting and maintenance in parking lots
- Monitoring of tree protection and proper planting during site development
- Acquisition of open space or easements to preserve existing forest in urban areas
- Metrics to calculate the amount of pollution removed by urban trees and the associated improvement in air quality.

And it's not just planners that need to be engaged! Public works officials clearly play a crucial role in facilitating the success of urban forestry, and urban foresters and arborists in such departments can point the way to new environmentally friendly public works programs. One of the recurring issues involving trees concerns their placement and root structure in municipal rights-of-way, particularly on residential streets, where the same space must accommodate water and sewer lines and perhaps underground utilities.

Engineers work in both the public and private sector in varying capacities. Utility companies, including energy companies, but also telephone, cable television, and other service suppliers, involve engineers in siting and designing much of this infrastructure. Whether these lines are overhead or underground, their siting and design have implications for nearby trees on both public and private property. Utility engineers should be aware of those issues and be involved in resolving conflicts between them. There are many techniques to reinforce soils under sidewalks to provide more stable trees and less interference with sidewalks.

Building green begins at the conception of the project, not at the construction phase, and should involve an arborist or forester to help determine what sort of trees and vegetation will have the best chance of thriving in the environment altered by construction. And arborists or urban foresters should continue to collaborate with the developer until the project is completed.



Case Example of Green Infrastructure Strategy In Summerville, SC – Conserving Green Infrastructure at the Town Scale

The Town of Summerville, SC received technical support and funding from the SCFC and the GIC to create a green infrastructure plan. Located in the Low Country region of South Carolina, the town has been challenged with high growth rates, driven by its location near the City of Charleston and its small town charm and abundant historic and natural resources. The Town of Summerville's Comprehensive Plan sets several goals that address the need to recognize, preserve, and protect the town's natural and cultural resources and ecosystem services. These goals guide the development of their green infrastructure plan.

The majority of town lies in an urban/suburban landscape and thus lacks large tracts of undeveloped, forested land that can qualify as core forest habitat. However, it has an extensive urban canopy at 51 percent that provides multiple values for the town residents, businesses and wildlife. They received assistance from SCFC to identify forested areas in need of reforestation or preservation. Summerville's motto, the *Flower Town in the Pines* stems from its long history as a place of respite from plantations along the Ashley River, due to its higher elevation and cooling forest. It is also lays claim to being the birthplace of sweat tea – a true southern tradition.

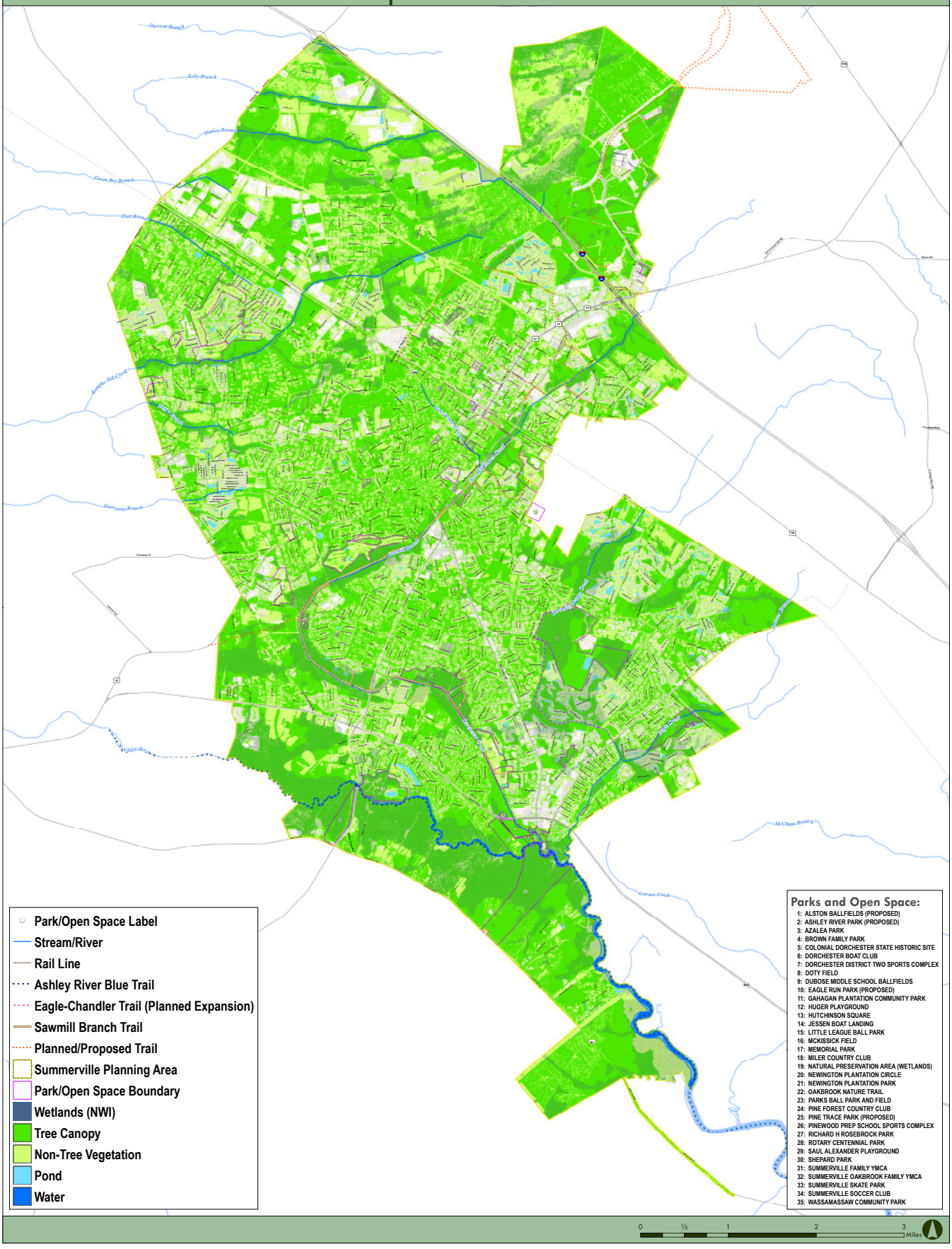
According to the plan "The Town of Summerville began the green infrastructure (GI) planning process to identify its most valuable natural assets to help facilitate future development in a manner that will reduce its impact on identified areas. Green infrastructure is identified as the natural assets of an area, including intact forests, tree canopy, wetlands, parks, rivers, and agricultural soils. In addition to sustaining plant, animal, and human communities, the green infrastructure of an area provides many ecosystem services, such as, maintaining air quality, water quality and mitigating flooding. This plan identifies the potential for restoration of ecosystem services, where possible, as well as supports and informs existing and projected regulatory plans (i.e. Comprehensive Plan, Vision Plan, Unified Development Ordinance) as the Town works to balance the economic, social, and environmental concerns that an ever growing community should address."

The plan includes extensive analysis of the town's urban canopy and connected green networks as well as overlay maps of cultural and water resources. The plan provides the data and locations for key green resources to inform future growth and development. The plan also includes key goals and actions for the town to conserve or restore these resources. The town implemented a successful community engagement component working with its planning commission, a technical advisory committee, the town council and with technical support from the Green Infrastructure Center.

In Summerville, the GIC created the tree canopy map and other map overlays guide the establishment of environmental and social goals. Examples of town strategies include the following – and there are many more! See the resources section in Appendix A to download the entire plan and all maps.

One of several community open houses allowed residents to comment on plan goals.

Habitats for Wildlife and People



From backyards to extensive forests along the Ashley River, residents supported maintaining and expanding their urban trees..

VISION: The Town of Summerville encourages responsible land development and growth patterns promoting sustainability and balance of the natural and built environment.

GOAL A: HABITATS FOR WILDLIFE AND PEOPLE -- PROTECT, PRESERVE, AND EXPAND THE EXISTING NATURAL SCENIC RESOURCES AND OPEN SPACE WITHIN THE SUMMERVILLE PLANNING AREA.

RATIONALE: As one of the first towns to pass a tree protection ordinance (1847), and as a 'Tree City USA' the town has a longstanding commitment to protecting its natural resources. The tree canopy is calculated at 55%, which is very good. However, trees are not distributed evenly. In order to maintain a healthy canopy over time, and in the right places, more effort will be needed. Trees provide shade, air quality, bird habitat, energy savings and stormwater uptake. Meadows and other landscapes support a multitude of wildlife as well. In order to have a healthy landscape for both people and wildlife, natural areas and clusters of habitat should be protected and connected.

OBJECTIVE A 1: Promote the retention of native vegetation, especially trees, and the removal of invasive species, and encourage species diversity in plantings.

There are many opportunities to enjoy hiking and birding but they should be widely promoted.

TASK 1: When the Comprehensive Plan is updated, include key natural and critical areas as Future Land Use Focal Points described in the Future Land Use Element of the Comprehensive Plan.

TASK 2: Create a recommended planting list of trees, shrubs, and grasses and a list of prohibited invasive species.

TASK 3: Amend tree ordinance to allow the automatic approval of invasive species removal.

TASK 4: Amend ordinance to require a diversity of tree species be planted if more than five trees are required to be planted on a single parcel to avoid monocultures.

OBJECTIVE A 2: Become a more bird friendly community and pro¬mote birding opportunities in the Town.

TASK 1: Continue relationship with the Audubon Center at Beidler Forest to create bird friendly environments throughout the Town, which may include work towards being designated as an Audubon Climate Resilient & Bird Friendly Town.

TASK 2: Map birding opportunities in the Town with input from Audubon and other organizations.

TASK 2: Promote existing birding opportunities and bird related tourism and education (i.e. B.I.R.D.S. public art initiative) by providing links on the Town's website and information in Town Hall.

OBJECTIVE A 3: Educate the public about how to create native habi¬tats in their yards through programs such as the Clemson Extension Carolina Yards program.

TASK 1: Partner with Clemson Extension, Native Plant Society, and/or Master Gardener/Master Naturalist groups to host an annual educational workshop.

TASK 2: Provide links to educational information about native landscaping on the Town's website.

OBJECTIVE A 4: Create a Town Arborist position to manage Town trees long term and provide education about their benefits and care. The arborist may undertake the following tasks:

TASK 1: Develop a comprehensive management plan for pruning, treating, watering existing Town trees.

TASK 2: Work with developers to educate them about tree planting and care to increase the survival rates and lifespan of trees planted in commercial and residential developments.

TASK 3: Research and pursue grant opportunities for tree plantings, and work with volunteers to create a non-profit organization for tree planting in the Summerville area similar to Charleston Trees.

Rural Areas

Comprehensive plans often recognize the importance of 'open space.' However, not all open space is of equal value. An overgrazed field and a relatively pristine forest could both be considered open space. The field may be contributing sediment to waterways through erosion, while the forest is preventing erosion and providing habitat and water filtration. Thus, it's important to have an assessment of the quality and extent of all open spaces.

As explained in an earlier chapter, large intact areas of habitat that are well connected through corridors are best for supporting a healthful and biologically diverse landscape. The model to create a map of large habitats for South Carolina's large landscapes is available from the GIC at no cost. To create a canopy map, there are many firms, such as GIC, that can analyze aerial imagery for a fee and there are some new tools available to create canopy maps without the use of complex software.

Once a map of cores is created, it can be used to determine the largest and most significant habitats and to find key corridors – especially rivers – that connect them. The key is to visualize the landscape in terms of a potentially interconnected network of cores for animals to utilize, as well as residents to use for leisure activities such as hunting or horseback riding. An interconnected network also supports birds, pollinators, and other wildlife.

Assessing the Values of Forests

Before considering uses, the first step for planning for an entire county is to know where the highest value landscapes are located. By *highest value* we mean those forests that are significantly large, are likely to support a diverse ecosystem, provide habitat for known rare species and provide other human values, such as protecting water quality.

Rural areas, and even undeveloped areas of cities and suburbs, may contain large intact forests. These forests may vary in their health, management and uses. A forest managed continuously for forestry may have different uses and goals than one set aside for wildlife management or recreation. And it will certainly have different varieties of trees and different habitat and recreation values.

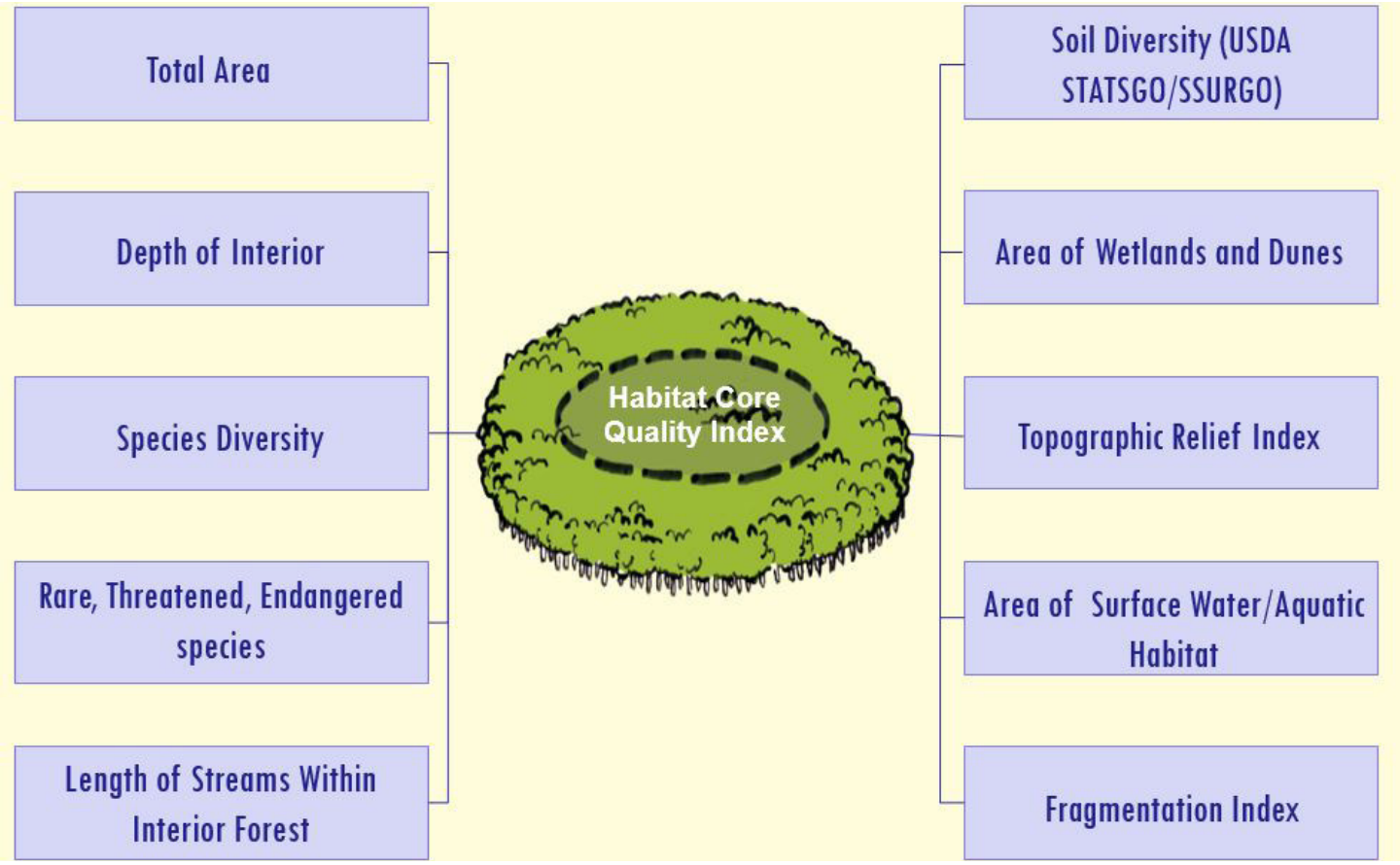
A common rule for a minimum sized intact forest that is likely to support a diversity of species is 100 or more acres. This comes from studies of avian species and minimum forest size needed to support a nesting and foraging habitat for most eastern species. A forest should also be as intact as possible, meaning that it is not overly fragmented (broken into small pieces and bisected by disturbances such as roads or power lines), and not possessing too many edges that will allow invasive species and other disturbances, such as wind, to impact the forest. As noted there is a free model of these habitats available from the GIC (see following paragraphs for more).

It is important to realize that depending on the uses being assessed, values assigned to forests will vary. Given that fact, forests can be managed for many different values, and not just one. A forest can be managed for *both* forestry and wildlife. Or, it could be managed for multiple leisure activities, clean water, habitat and selective timbering. Accordingly, it is important to first understand how the land is intended to be used. If the forest is publicly owned, determining a strategy for it is relatively straightforward and the forest can be managed according to a locality's goals.

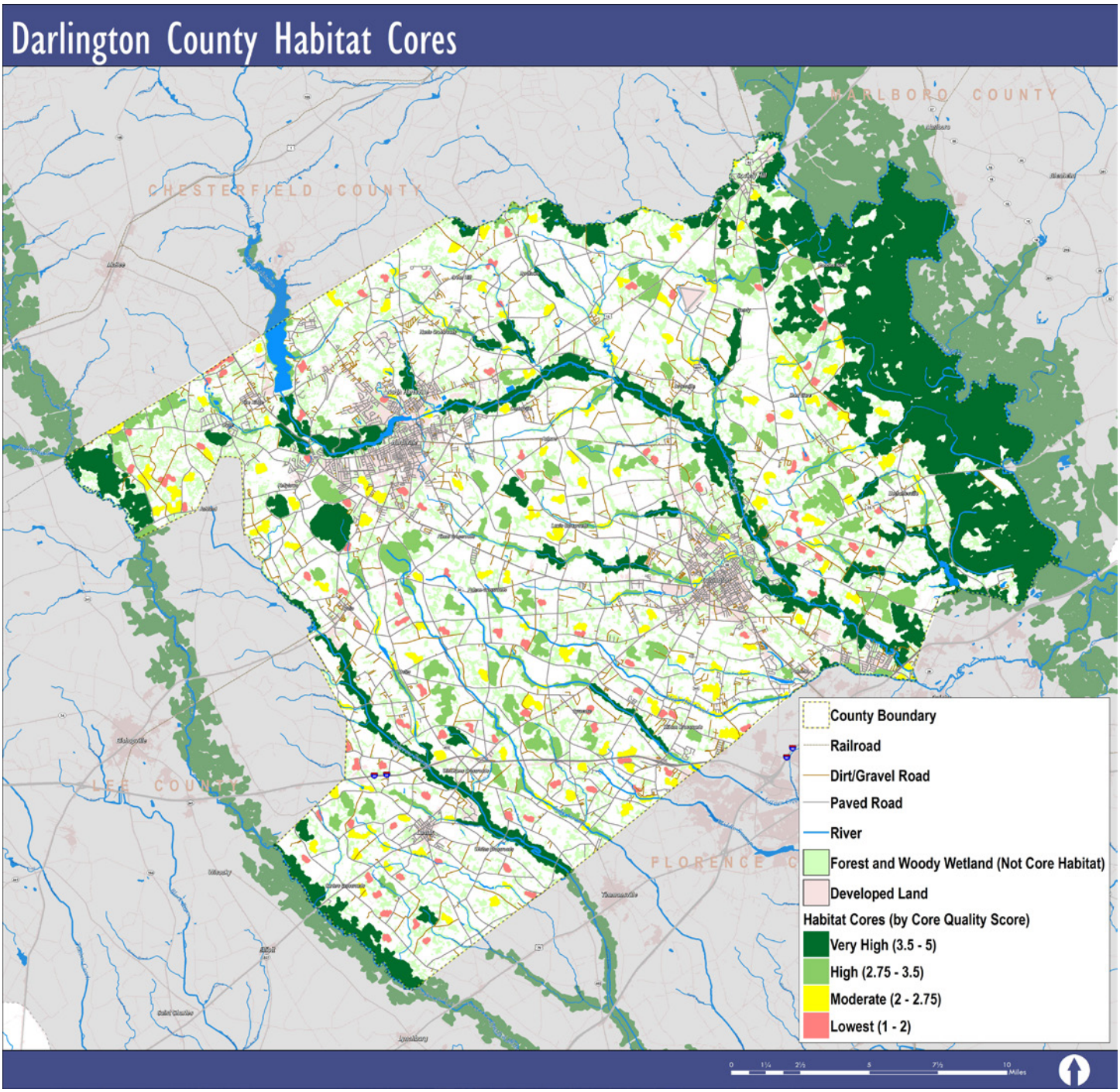
If the land is owned by a forestry company, it would be worthwhile to ask them how they plan to use it, especially if they own many large forested tracts. They may be amenable to working with the locality on reaching its overall goals, such as for clean water protection, stream buffers or providing more leisure opportunities, such as hunting or trail riding. For example, in Berkeley County, one large forestry company planned to sell all its holdings for suburban housing developments, while two others planned to continue to manage their lands for forestry far into the future. This provided the locality's planners and foresters with crucial information as to which lands they could count on to remain under rural uses. To best protect existing forestry operations, it will be important to avoid putting less compatible uses adjacent to them. For the company planning to sell, this indicated to the county which lands would likely be developed.

If one landowner is converting his or her forestry land into subdivisions, it's reasonable to assume that other nearby properties will also soon be developed, unless the locality decides to impose zoning or other regulations on them, such as conservation easements or PDRs (purchase of development rights).

Fortunately, as noted, the State of South Carolina has an intact forest habitat model that can be downloaded and applied to determine the intactness of forests in the state. It requires the use of Geographic Information Systems (GIS) to apply and run the model. There is also a book for South Carolina; *Green Infrastructure Planning: A Practitioner's Guide* which explains how to use the model to map and plan for protecting large intact forests, and other habitats such as wetlands (see resources section). The guide contains the six-step process for using the model as well as tips for engaging the community and convincing landowners and community leaders to support landscape conservation.

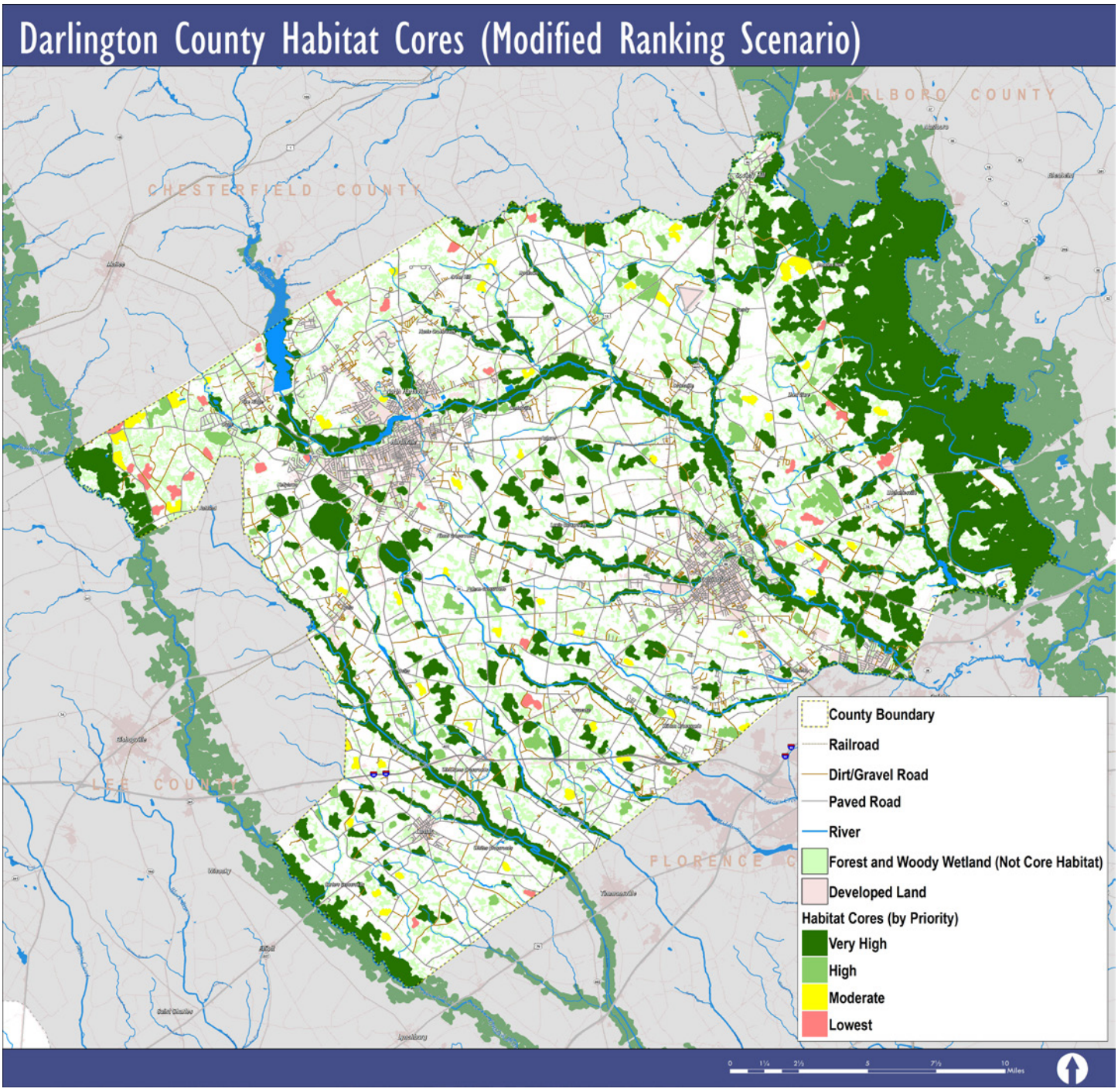


A number of factors are used in the South Carolina Cores Model to rank the quality of the habitat and the likelihood that it can support a diverse and healthy ecosystem.



Running the model will result in a map of the largest and highest quality landscapes for the locality. The next step is to update the model to remove any areas developed since the model was created, to add local priorities such as ranking an area more highly because it supplies drinking water or support a heritage resource, such as a plantation, a battlefield or Native American artifacts. The practitioners' guide referenced on page 39 and in the Appendix, provides the steps and process for creating local maps, setting priorities and evaluating risks and opportunities.

In Darlington, SC the county used the habitat cores map to find the most intact landscapes. They also used a ranking system to further prioritize the cores for local goals. For example cores that were important for water quality were upgraded and ranked as having more value. Cores that connected key areas or were near to towns also were ranked more highly. Another example are the Carolina Bays – a unique remnant landscape feature that were mapped using GIS. The maps above show the differences once the community committee added their priorities to the model to create a custom map that reflects what's important to the county. The



map at left shows the original ranking while the map at right shows new rankings that increased the values of cores which supported key community goals, such as protecting water quality.

In addition to ecological values, economic values can also – and should be – included in comprehensive plans. The Census of Agriculture is conducted every five years (the last two were in 2012 and 2017; see https://www.agcensus.usda.gov/). This census provides key data on crop types, acres under production, changes to the number of farms and the sizes of those farms that remain. This is very helpful, packaged data from the USDA, which can be utilized by rural counties to paint a more accurate picture of their agricultural economy.

Forest economic data at the county level can be obtained from the Census Fact Finder using the Advanced Search tool. Use both the Industry Codes and the Geographies search tools to sort by industry type in specific locations. The industry code for forestry is 113. Users interested in the values of natural resources may want to search for other helpful codes, such as the economic values of fishing and hunting.

Final Note

This guide has provided a rational for including sound data and maps in comprehensive plans. The next step for readers is to ensure that they are accessing all the good information to inform their comprehensive plans such as soils data for agriculture, tree canopy data for cities, large intact habitats from the GIC habitat model, river and stream quality data from South Carolina Department of Health and Environmental Control, and other data to reflect the locations of key resources within the comprehensive plan.

In addition, zoning (if available) should be overlaid to see areas where zoning may not be appropriate such as industrial zoning over a sensitive aquifer or many small parcels over a habitat core zoned residential when another zoning class such as conservation may be more appropriate. The South Carolina book *Evaluating and Conserving Green Infrastructure Across the Landscape: A Practitioner's Guide* shows how to assess risks to habitats and can be used to inform goal setting – what are the localities most important assets, which are at risk, and which require action to protect, expand or restore them? Answering these questions will help to create policies and goals that directly address what is most needed.

Consult the Appendix section of this guide for resources, case examples and useful references. Engage with local experts – there are many people available to help localities – the county, city or town do not need to be the expert! Utilize the State Forestry Commission staff, Clemson University Extension, local colleges (students and professors), volunteer experts within the community. The locality's staff may have hidden talents – they may be arborists, landscape architects, biologists or mapping wizards. Tap into the tremendous resources, human capital, free guides and models and create a comprehensive plan that is information rich, inspiring, strategic and most importantly, useful!

APPENDIX A: Resources and Citations

When Possible, Web Links Are Provided.

Green Infrastructure Planning For Landscapes:

Evaluating and Conserving Green Infrastructure Across the Landscape: A Practitioner's Guide, South Carolina edition https://www.state.sc.us/forest/gic-sc15.pdf

South Carolina Ecological Communities https://www.fws.gov/charleston/pdf/South%20Carolina%20Ecological%20Communities.pdf

South Carolina Forestry Commission Technical Support: https://www.state.sc.us/forest/refserv.htm

Urban Forestry South: https://www.urbanforestrysouth.org/resources/library

Ten-Year Urban Forestry Action Plan: Key ideas for strategies. https://urbanforestplan.org/engage/

Greenways and Open Space Fact Sheet: https://www.scdhec.gov/HomeandEnvironment/docs/ModelOrdinances/GreenwaysandOpenSpace.pdf

Sherer, Paul M. "Why America needs more city parks and open space." The Trust for Public Land (2003). http://www.tpl.org

Hazard Planning

South Carolina Flood Resources Guide: An interactive guide to help communities prepare, respond, and adapt to flooding events. http://www.sccoastalinfo.org/wp-content/uploads/2017/06/SC-Flood-Guide-Final.pdf

NOAA Sea Level Rise Viewer: https://coast.noaa.gov/digitalcoast/tools/slr

Climate change impacts for natural resources in South Carolina: http://www.dnr.sc.gov/pubs/CCINatResReport.pdf

Land Use and Sea Level Rise: Practice Tips for Land Use Practitioners in the Wake of Changing Regulatory Schemes: Tips for how to plan for and deal with flooding and flood prone areas, especially sea level rise. https://www.americanbar.org/publications/probate_property_magazine_2012/2015/july_august_2015/2015_aba_rpte_pp_v29_3_article_negro_land_use_and_sea_level_rise.html

Key Regulations:

South Carolina Forest Management Protection Act and other forest regulations: https://www.state.sc.us/forest/reflaws.htm#pro

Semon, Kathleen E. "The Role Of "Planned Unit Developments" In Environmental Management In The Coastal Zone": https://www.scdhec.gov/HomeAndEnvironment/Docs/OCRM_PUD.pdf

Comprehensive Planning

Comprehensive Planning Guide, 2014. Municipal Association of South Carolina, http://www.masc.sc/SiteCollectionDocuments/Land%20Use%20Planning/Comp%20Planning%20Guide.pdf

South Carolina Comprehensive Planning Authority: http://www.scstatehouse.gov/code/t06c029.php

Forest Industry and Forest Cover in South Carolina
The SC Forestry Commission summary reports about the forest industry at the state level. For more see: http://trees.sc.gov/ppt/SCForestProductsExportsUpdate0615.pdf

Harper, R. A., & Rominger, B. (2013). South Carolina, *2012-forest inventory and analysis factsheet*. https://www.srs.fs.usda.gov/pubs/su/su_srs083.pdf

Tree Survival and Care

Roman, L. A., & Scatena, F. N. (2011). *Street tree survival rates: Meta-analysis of previous studies and application to a field survey in Philadelphia, PA, USA. Urban Forestry & Urban Greening, 10*(4), 269-274. https://pdfs.semanticscholar.org/8498/8a43c181d2bac23650d2309ae125e3115ceb.pdf

Sustainable Urban Forest Guide: http://www.itreetools.org/resources/content/Sustainable_Urban_Forest_Guide_14Nov2016.pdf

Roman, Lara A., John J. Battles, and Joe R. McBride. "The balance of planting and mortality in a street tree population." Urban Ecosystems 17, no. 2 (2014): 387.

London, Donna s., Ham, Donald L. July 2006. *Planning for the Community Forest in South Carolina*. The Jim Self Center On The Future Strom Thurmond Institute Of Government And Public Affairs Clemson University. http://sti.clemson.edu/publications-mainmenu-38/commentaries-mainmenu-211/cat_view/29-jim-self-center-on-the-future/254-sustainability-and-natural-resources

Tree Benefits

The large tree argument, *USDA Forest Service*. https://www.fs.fed.us/psw/topics/urban_forestry/products/cufr_511_large_tree_argument.pdf

Human Dimensions of Urban Forestry and Urban Greening – web site of references, statistics and resources: http://www.naturewithin.info/
http://www.itreetools.org/resources/content/Sustainable_Urban_Forest_Guide_14Nov2016.pdf

Wolf, K. L. (2008). *City trees, nature and physical activity: A research review. Arborist News*, 17(1), 22-24.

Wolf, Kathleen L. "Nature and commerce: human ecology in business districts." In *Building cities of green: proceedings of the 1999 national urban forest conference. Washington, DC: American Forests*, pp. 56-59. 1999. https://www.naturewithin.info/CityBiz/1999AmFor.pdf

Wolf, Kathleen L. "Business district streetscapes, trees, and consumer response." *Journal of Forestry* 103, no. 8 (2005): 396-400.

South Carolina Champion Tree Lists: http://www.clemson.edu/public/champtree/index.html

Tree Canopy

NAIP Data: https://gdg.sc.egov.usda.gov/GDGHome_DirectDownLoad.aspx
I-tree tools (I-tree eco, I-tree hydro, I-tree canopy etc.)
https://www.itreetools.org/

Nowak, D.J., and E.J. Greenfield. 2012. "T*ree and impervious cover change in U.S. cities." Urban Forestry & Urban Greening*, Vol. 11, 2012; pp 21-30. http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1239&context=usdafsfacpub

Nowak et al. 2010. *Sustaining America's Urban Trees and Forests*: https://www.fs.fed.us/openspace/fote/reports/nrs-62_sustaining_americas_urban.pdf

Trees and Stormwater

Cappiella, K., Schueler, T., & Wright, T. (2006). *Urban Watershed Forestry Manual Part 2 Conserving and Planting Trees at Development Sites*.
https://www.na.fs.fed.us/pubs/uf/watershed2/urban_watershed_forestry_manual_part2.pdf

Stormwater to Street Trees: http://www.davey.com/media/183712/stormwater_to_street_trees.pdf

Fazio, James R. "How trees can retain stormwater runoff." Tree City USA Bulletin 55 (2010): 1-8.

How trees can retain stormwater runoff. *Tree City USA Bulletin*, 55, 1-8.

Penn State Extension, Trees and Stormwater
http://extension.psu.edu/plants/green-industry/landscaping/culture/the-role-of-trees-and-forests-in-healthy-watersheds

Buffer zone guidance for stormwater management programs:
http://www.scdhec.gov/library/cr-010475.pdf

Vegetated Riparian Buffers and Buffer Ordinances: A South Carolina guide to buffer design. http://cwsec-sc.org/wp-content/uploads/techdocs/sc_vegetated_riparian_buffer_ordinance.pdf

Water Quality

South Carolina Department of Health and Environmental Control for state sampled data
http://www.scdhec.gov/HomeAndEnvironment/Water/MeasuresSurface/

South Carolina Adopt a Stream Program: engage volunteers in sampling water quality to expand knowledge about water resources and their quality as well as to encourage public water stewardship.
http://www.clemson.edu/public/water/watershed/scaas/

Schueler, Thomas R., P. A. Kumble, and M. A. Heraty. *A current assessment of urban best management practices*. United States Environmental Protection Agency, Office of Wetlands, Oceans, and Watersheds, Assessment & Watershed Protection Division, 1992.

Forest Fire Safety

Ready Set Go Program http://www.wildlandfirersg.org/

South Carolina Firewise Program http://www.state.sc.us/forest/firewise.htm

Urban Forest Management Costs

Cost of Not Maintaining the Urban Forest: http://www.isa-arbor.com/education/resources/CNMTArboristNewsArticle.pdf

Planning, Funding and Government Assistance Programs and Tools

Beaufort County TDR Program: http://smartpreservation.net/beaufort-county-south-carolina/

Conservation Easements in South Carolina: http://conservationeasement.us/reports/easements?report_state=South%20Carolina&report_type=All

Managing Residential Growth in South Carolina: A Citizens Guide. 2008. https://www.yorkcountygov.com/_fileUploads/forms/ManageResidentialGrowth.pdf

The Role of "Planned Unit Developments" in South Carolina's Coastal Zone: Synthesis Report. https://www.scdhec.gov/HomeAndEnvironment/Docs/OCRM_PUD.pdf

Natural Resources Conservation Service for South Carolina: Financial and technical assistance programs to conserve agricultural and forestal lands. https://www.nrcs.usda.gov/wps/portal/nrcs/main/sc/programs/easements/

Agricultural Conservation Easement Program: https://www.nrcs.usda.gov/wps/portal/nrcs/main/sc/programs/easements/acep/

Clemson Cooperative Extension Programs for forests, wildlife and water: http://www.clemson.edu/extension/forestry/index.html

South Carolina Conservation Bank: http://sccbank.sc.gov/Pages/default.aspx

South Carolina Conservation Easement Act: http://www.scstatehouse.gov/code/t27c008.php

Land Trust Alliance: list and links to SC land trusts, http://findalandtrust.org/states/south%20carolina45/land_trusts

Example Links For Cases Referenced

Richland County Conservation Easements: http://www.rcgov.us/Government/Commissions/ConservationCommission/Conservation/ConservationEasements.aspx

Urban Growth Boundaries: SC requirements and model ordinance. https://www.scdhec.gov/HomeandEnvironment/docs/ModelOrdinances/UrbanGrowthBoundary.pdf

City of Charleston: growth boundaries. http://www.charleston-sc.gov/DocumentCenter/View/513

Managing Residential Growth in South Carolina. A Citizen's Guide: https://www.yorkcountygov.com/_fileUploads/forms/ManageResidentialGrowth.pdf

City/County of Sumpter Conservation Districts: http://www.sumtersc.gov/Data/Sites/1/media/departments/planning/ordinance-plans-reports/0911updates/county/article-2.pdf

Summerville Green Infrastructure Plan: http://www.summervillesc.gov/GI

B APPENDIX B: Strategy Worksheet

This worksheet is intended to help craft a strategy. If the strategy is intended to achieve a larger vision, a vision statement is usually prepared. Vision statements look toward future desired conditions and should be inspiring and achievable.

A strategy contains the purpose and action plan to help you achieve your goals. A goal explains what you want to achieve and why. An objective details what you will achieve/do to meet your goal. An objective should be measurable and quantifiable. You should be able to tell if you did it or not, so objectives should be as specific as possible. The following is a suggested format.

A timeframe for each objective should be included. You may also add specific benchmarks along the way so if your goal will take two years to achieve you may also have specific benchmarks to help determine if you are on track to meet your objective. If you miss a benchmark, then evaluate why and what fixes may be needed to achieve your benchmark and ultimate objective. An objective can help to meet more than one goal.

Goal 1: What you want to achieve and the purpose for doing so.
Obj. 1A: A specific measurable outcome to achieve the goal above.
Task 1: A specific task to achieve the objective 1A.
Task 2: A specific task to achieve the objective 1A.
Task 3: A specific task to achieve the objective 1A.

Timeframe: by a specific date or over a defined period of time.

Responsible parties: identify who will participate in the objectives and in each task.

Cost: If your strategy has a cost, define the amount and ideally, the source of the funding.

A good strategy needs to have measurable outcomes. For example, if your goal is to restore the health of your watershed by increasing infiltration of rainwater and you have determined that forest cover is important to help do achieve this goal, you should have objectives that are specific to meeting this goal. Avoid vague statements such as, "Plant more trees," or "Increase forest canopy." How many more trees, how much new canopy, and where is it needed? How much of your area is currently forested? Do you need to increase that amount and if so, by what percent? Where is forest cover most needed? Is your area forested on the ridges, but not along valley streams? If you determine that forested stream buffers are needed, how wide a buffer can you recommend and for how many miles? How will you measure achievement of this objective? Who will do this work and who will pay for it? Who will track progress and make changes if sufficient progress is not met?

Optional: You may also include a rationale in which you state 1-2 paragraphs on the background of the issue or need for which you are writing your goal. Your rationale can follow each goal. Here you can include key statistics or data about the current state of the resource and why action is needed. This provides the reasons and basis for your goal for others who may not be familiar with the issue. An example is provided on the following page.

STRATEGY WORKSHEET **Date:**_____

Your Name(s) for reference:_____

WHY
Goal #_____

WHAT
Objective#: _____

HOW
Task 1: _____

Task 2: _____

Task 3: _____

WHO
Responsible parties:_____

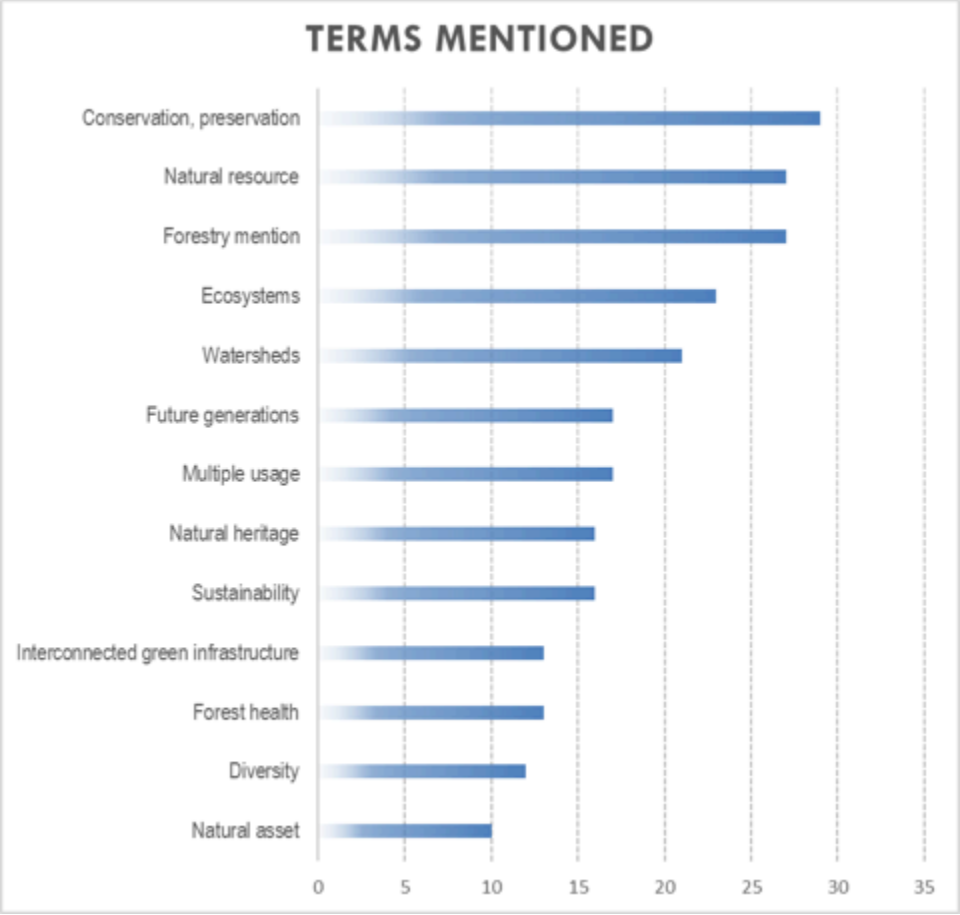
_____

Cost:_____ **(optional, add sources for $)**_____

Timeframe: _____

C APPENDIX C:
Tables of Comprehensive Plan Research Results

TABLE 1: ENVIRONMENTAL TERMS MENTIONED IN COMPREHENSIVE PLANS



Our research ranked counties for the frequency and quality of forest references. While 27 of the localities surveyed mentioned forests, Table 1 shows how many other, related environmental terms were mentioned. The greatest number of forestry mentions were by Beaufort, Newberry, York and Jasper Counties.

TABLE 2: TIMES BENEFITS OF FORESTS WERE MENTIONED; BY BENEFIT TYPE

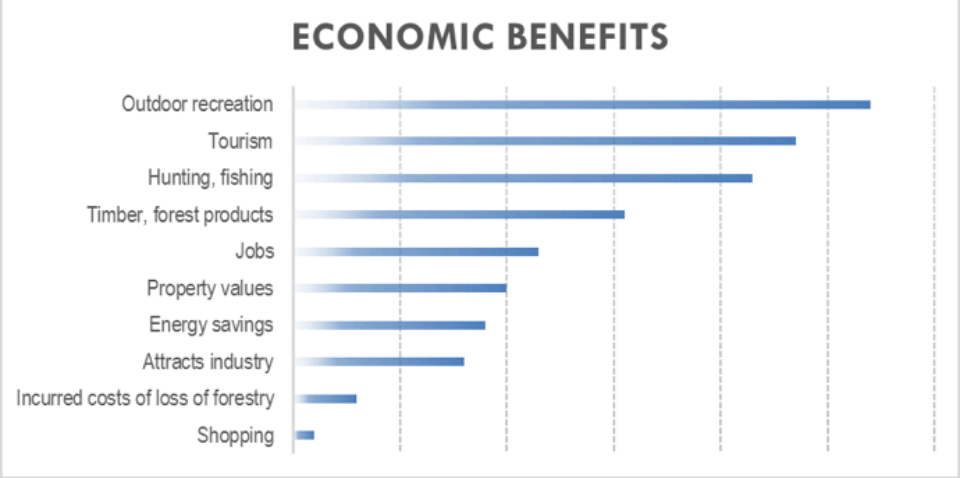
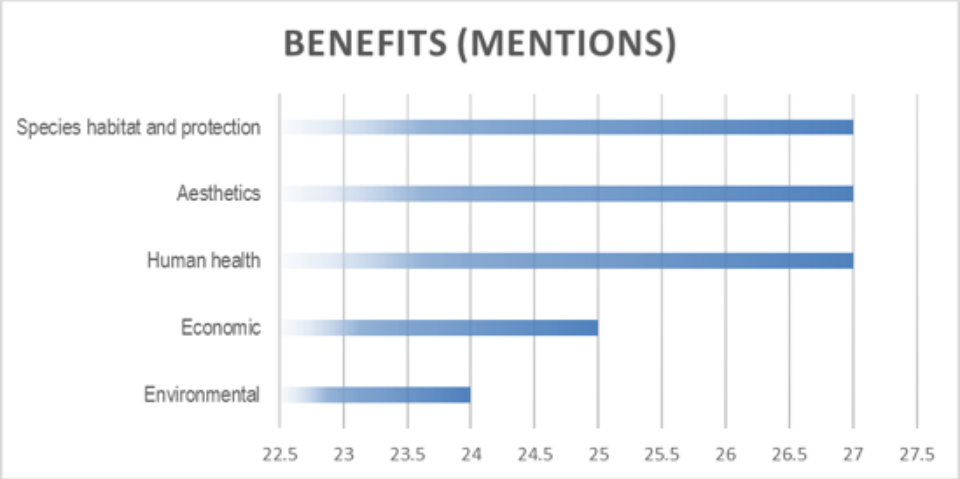


TABLE 3: ECONOMIC BENEFITS



For plans that mentioned the benefits of forestry, they were further broken down by benefit type. Species habitat, aesthetics and human health received the most mentions, while economic benefits and general environmental benefits were mentioned somewhat less.

These benefits tables can be used to gauge which values are currently recognized, as well as areas where more inclusion of concepts are needed, such as for air quality and mental health benefits and uptake of toxic compounds.

TABLE 4: SPECIES BENEFITS

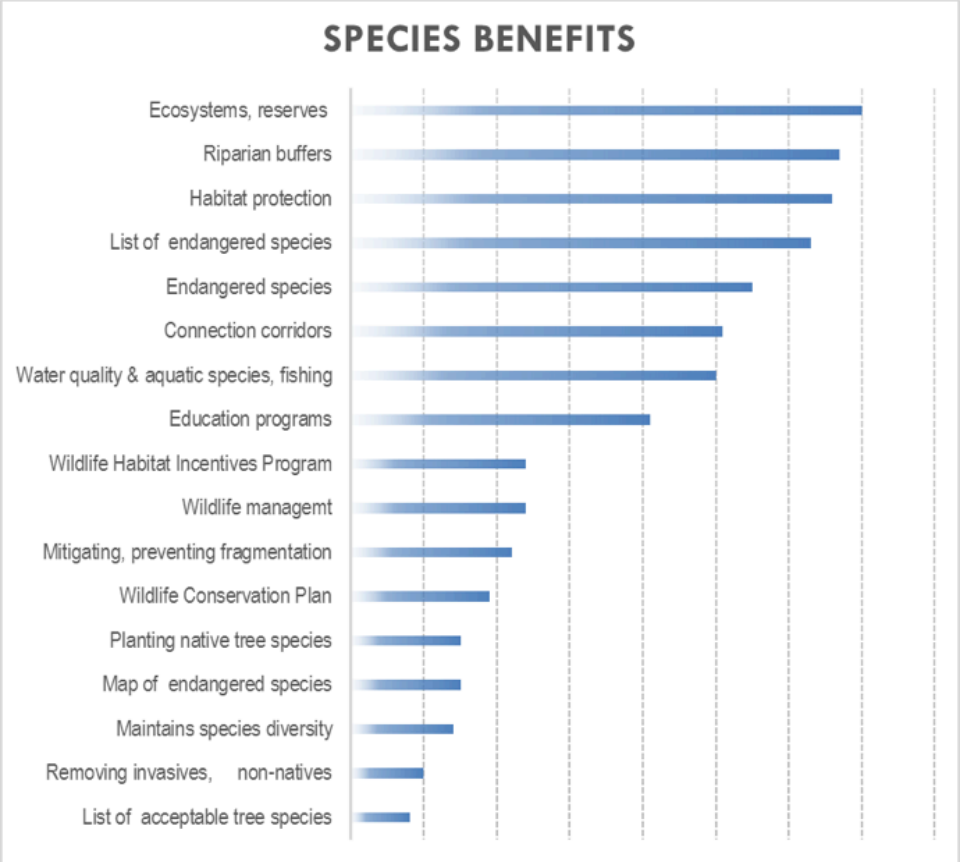


TABLE 5: AESTHETIC BENEFITS

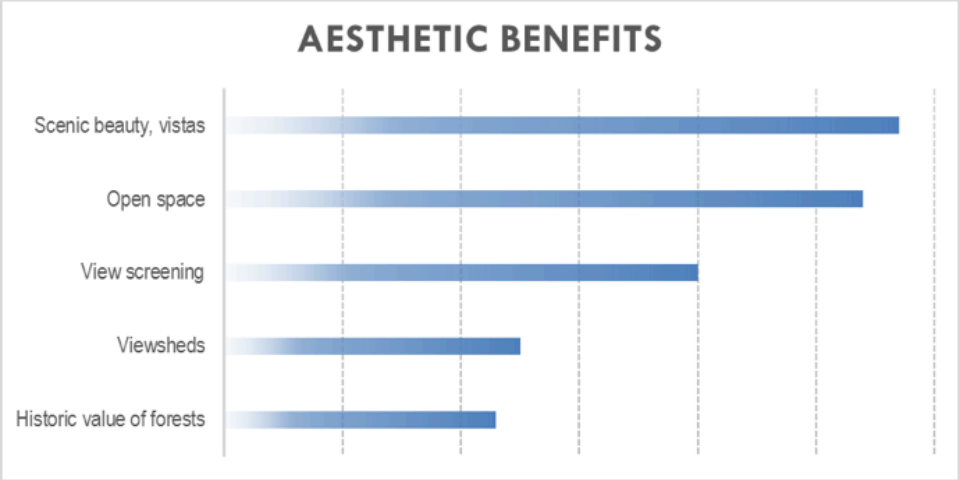


TABLE 6: HUMAN HEALTH BENEFITS

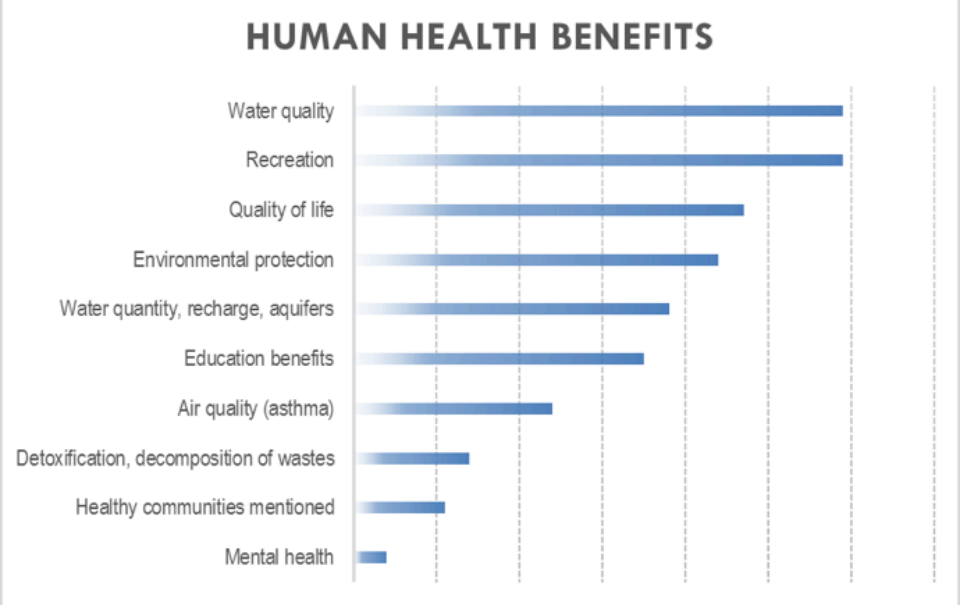


TABLE 7: ENVIRONMENTAL BENEFITS

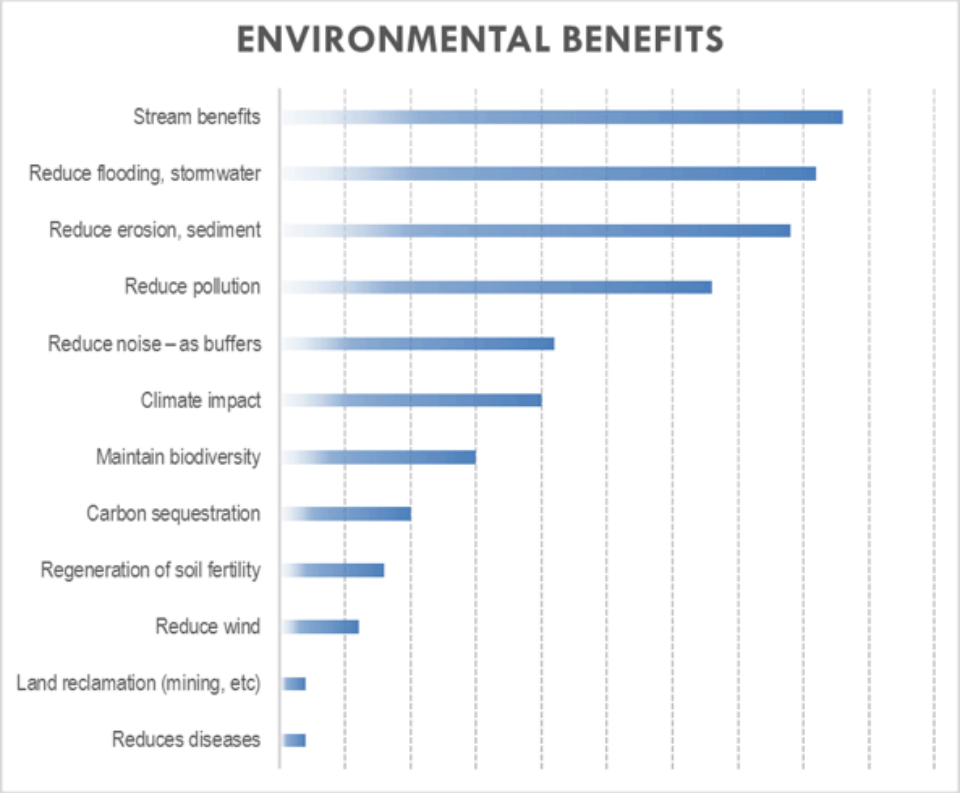


TABLE 8: THREATS TO FORESTS

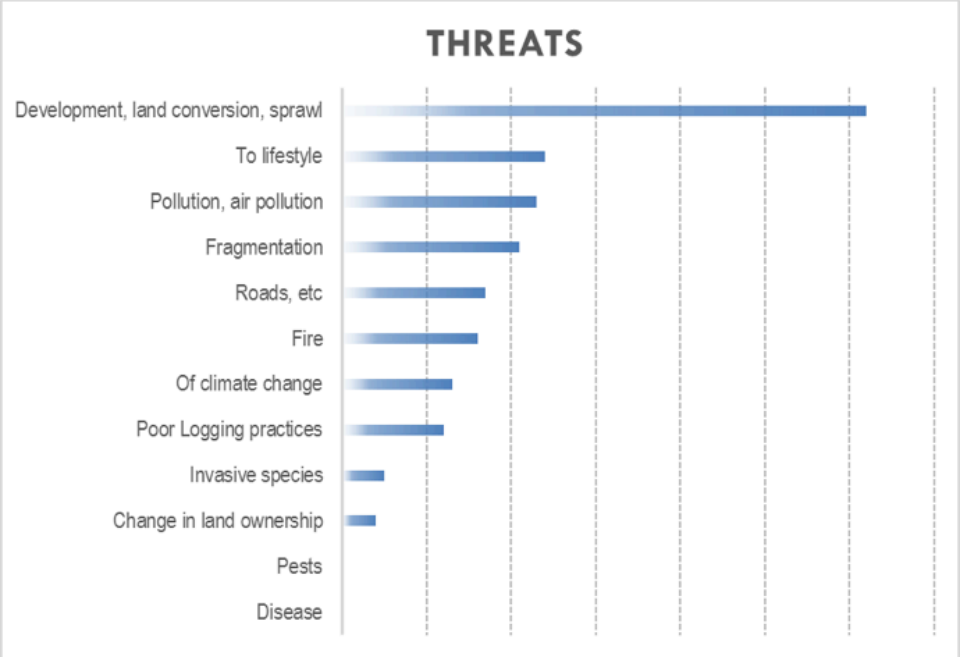


TABLE 9: ECOSYSTEM SERVICES AND DIRECTED DEVELOPMENT

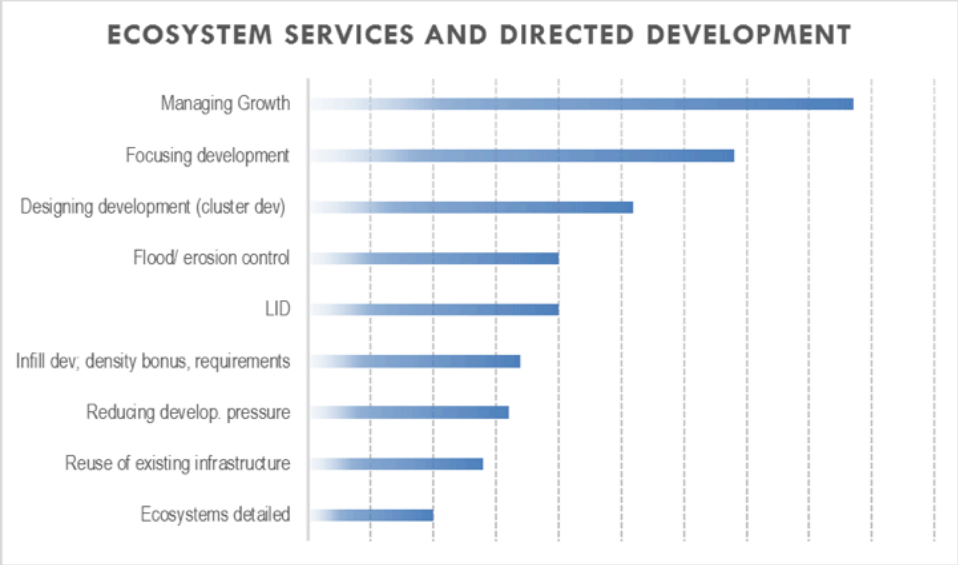


Table 9 shows results for localities, most [27] of whom mentioned ecosystem services and the degree to which the following tools are utilized and applied to provide benefits beyond timber values.

TABLE 10: ECONOMIC INCENTIVES

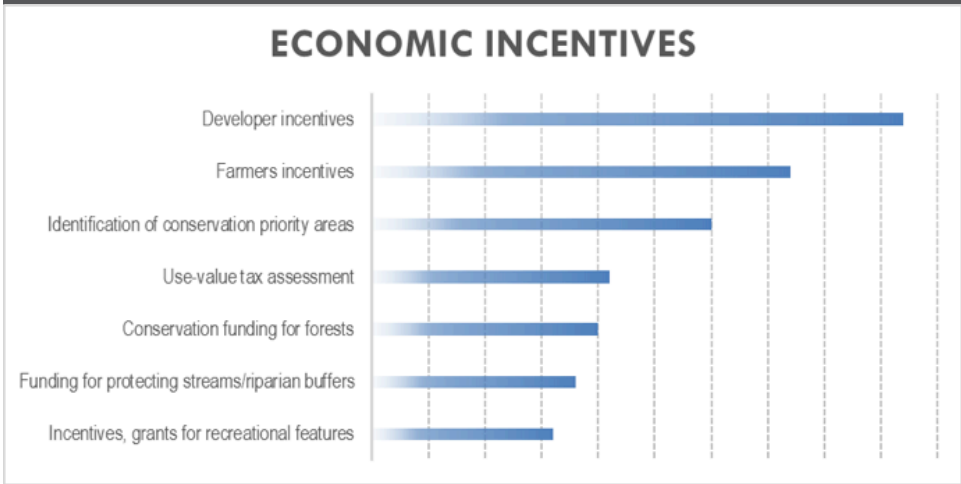
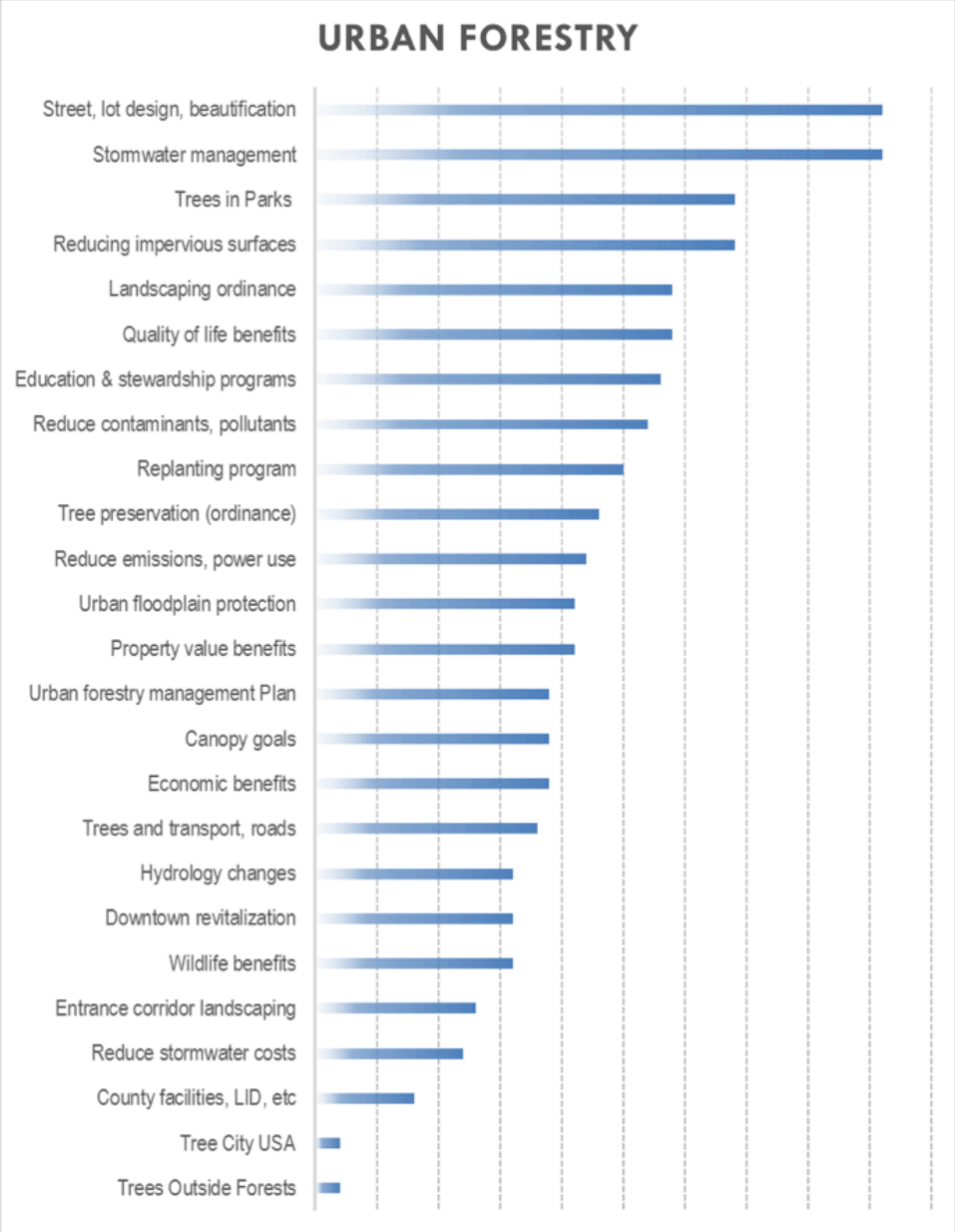


Table 10 shows the degree to which economic tools are applied for forest protection, such as incentives for developers or farmers to conserve forests.

Urban forests are mentioned in 21 of the 30 plans surveyed. Note that some localities, which are very rural, may not have sufficient urban areas to warrant their inclusion. However, the breadth and depth of more detailed strategies shows that urban forests are a key focus for the comprehensive plans.

TABLE 11: STRATEGIES FOR URBAN FOREST MANAGEMENT



Some plans are exemplary in mentioning the benefits of forests and in having distinct actions to protect or restore them such as Beaufort, York, Newberry and Florence. For example, York County discusses specific benefits of open space conservation, such as protecting wildlife and protecting jobs, and they also identify specific programs and conservation partners to carry out the work.